

# SOME ECONOMICS OF POST-SECONDARY EDUCATION

A Critical Review

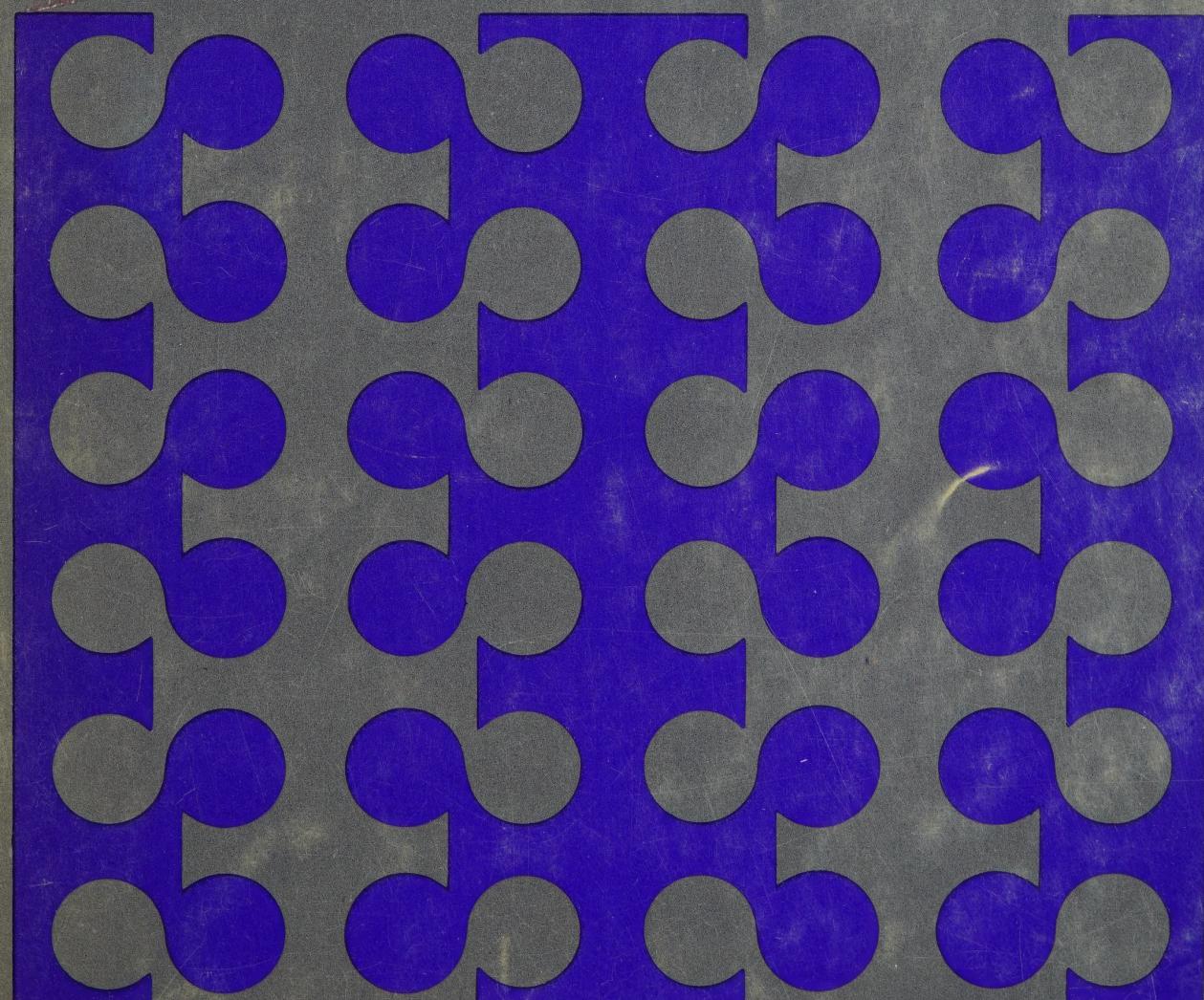
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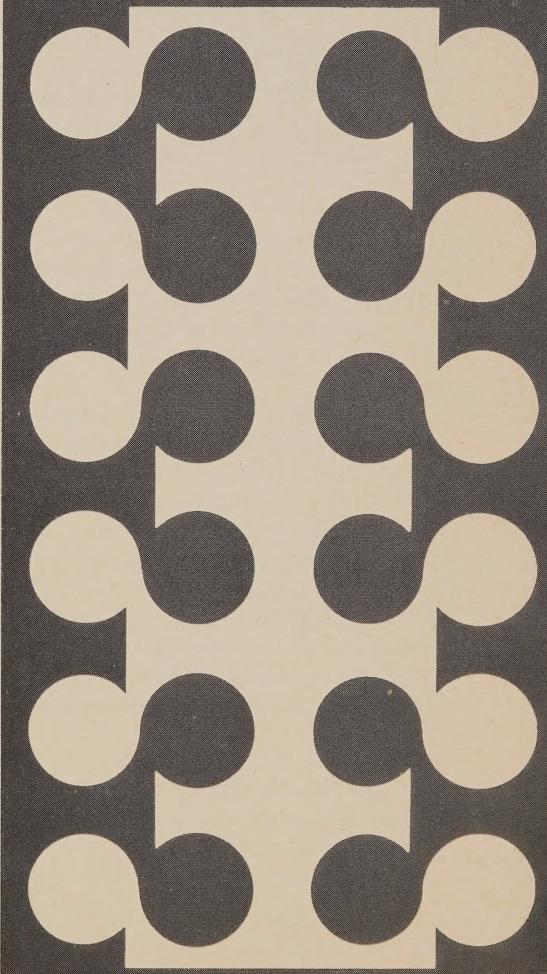
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# SOME ECONOMICS OF POST-SECONDARY EDUCATION

## A Critical Review

A Study Prepared for the Commission  
on Post-Secondary Education in Ontario



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of the  
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## **Some Economics of Post-Secondary Education: A Critical Review**

### **Editorial Foreword**

The Commission was required by its terms of reference "to consider, in the light of present provisions for university and other post-secondary education in Ontario, the pattern necessary to ensure the further effective development of post-secondary education in the province during the period to 1980, and in general terms to 1990, and to make recommendations thereon." Specifically it was also required to consider and make recommendations on "the patterns of student preference and demand in post-secondary education, especially as they are influenced by social and economic factors . . .," and "the costs, allocation of resources and methods of financing for post-secondary education in Ontario as related to the attainment of equality of educational opportunity and as related to the resources of the province."

These directions, as well as the widespread expressions of public concern over the economic aspects of post-secondary education, made it evident that an important part of the Commission's work would have to be with the economic and financial aspects of its subject. The Commission's first publication, *Post-Secondary Education in Ontario: A Statement of Issues*, (1970), devoted considerable attention to these matters, noting that "the cost—and the cost structure—of post-secondary education is one of the fundamental problems facing the public today" and, also, that despite the widespread belief in the economic benefits of post-secondary education, there are now serious questions being asked about the validity (or future validity) of such claims.

Some of the background studies prepared for the Commission have dealt directly with certain of these economic and financial issues associated with post-secondary education. Two such studies, the *Cost and Benefit Study* and *Financing Post-Secondary Education*, are published in the present series. Other background papers have touched indirectly on these issues.

Because of the rather technical nature of these aspects of the Commission's work, it appeared desirable to have a supplementary background study prepared, in the form of an essay on the present state of professional thinking on the subject of the economics of post-secondary education in general. Such a paper was seen as being important not only because a concise treatment of this complex body of knowledge would raise the level of public discussion of the policy issues involved, but also because it could serve to map out the limitations of the narrowly "economic" approach to the subject. It has been apparent for some time that experts in economics have much to contribute to the formation of social policy in this field. At the same time it is recognized that such expertise may be counter-productive if used clumsily or simply accepted uncritically by those responsible for making policy.

The Commission consequently prepared specifications for a separate study, the principal objective of which was to provide, in non-technical language, a general review of the literature on the economics of higher education and, more particularly, to survey the literature on human capital economics, unit cost analysis, private and social returns to educational expenditures, and to provide a critical

appraisal of the relevance of economics to education planning. A contract for such a study was awarded to Systems Research Group in June 1971, and their report is now published in the present volume. The project leader and principal author of the report was Richard W. Judy, Senior Principal of Systems Research Group and Professor of Economics at the University of Toronto.

Because this report is in the nature of a literature survey, combined with a necessarily subjective appraisal of the current state of the subject, no simple summary of its conclusions or implications can be set out. However, the discussion in Chapter III attempts to sum up the potential usefulness of economic reasoning as applied to problems of educational policy and planning. This and the discussion of the empirical contribution of economists to the subject described in Chapters I and II should be considered essential background reading for anyone seriously concerned with the issues to which the Commission has addressed itself and the recommendations which it has made in its report.

The following pages provide a lucid and coherent discussion of a body of ideas that has previously been relatively inaccessible to the public. The opinions and conclusions expressed in the study are solely those of the author, and publication does not mean that these opinions and conclusions are necessarily endorsed by the Commission.

SOME ECONOMICS OF  
POST-SECONDARY EDUCATION

A CRITICAL REVIEW

The research reported here was funded by the Commission on Post-Secondary Education of Ontario, as part of its research program. The work was produced by the Systems Research Group under the direction of Professor R.W. Judy

1971



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## INTRODUCTION

The economics of post-secondary education is, or ought to be, a subject with lots of scope. Studies of demand, of investment behaviour, of enterprise operation, of resource allocation and public finance - these are but a few of the areas of theoretical and empirical economics that are happily accommodated under the roof of this subject. Indeed, it is hard to think of another subject area that offers more scope to the economist to apply the tools of his trade.

Nevertheless, the economics of education - especially that of post-secondary education - is relatively underdeveloped. As an industry, its economics is studied less and understood more poorly than any industry of comparable size. In the last few years, this sorry condition has begun to right itself. There is now a respectable literature in existence; it is massive in quantity and growing in quality. This paper began as an attempt to survey the most important parts of this literature and to evaluate it from the point of view of its usefulness for policy making. It has gone some way toward becoming that, but much more could and ought to be done. Only the constraint of time prevents us from deepening and broadening the study as it deserves.



## I. Human Capital: Theory and Empirics

Not so long ago, within the memory of many of us who like to think of ourselves as being still young, there was no such thing as the Theory of Human Capital. Now it is the subject of tens of books and hundreds of articles; dissertations by the dozen treat its fine points; conferences are convened regularly to consider recent contributions. And, importantly for the present purposes, politicians ponder its prescriptions for public policy.

But if the development of a formal and systematic body of knowledge graced with a pretentious title is new, concern with the economic worth of human beings is very old. This concern has long been articulated by men of practical affairs and politics who worried about the questions that occupy us today. What is the economic value of a healthy labour force? How much should an individual or a society invest in education? What contribution do immigrants make to a country's economic growth and how much does emigration detract?

Early references in the literature to this subject were made by Sir William Petty, some three centuries ago.<sup>1</sup>

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<sup>1</sup> E.A.J. Johnson, "The Place of Learning, Science, Vocational Training and 'Art' in Pre-Smithian Economic Thought", Journal of Economic History, June 1964, Volume 24, No.2, pp.129-144.

Petty made quantitative estimates of the economic value of human beings as an aid to him in formulating policy recommendations concerning the transporting of people outside of London during the plagues and immigration policy. The English economist and moral philosopher Adam Smith compared the expenditure on education with the investment in expensive machines and noted that an educated man should expect an income "...over and above the usual wages of common labour, [which] will replace to him the whole expense of his education, with at least the ordinary profits of an equally valuable capital."<sup>2</sup> Smith also had many words about higher education which amply reward the modern reader.

The term "human capital" may have been coined by the great economist Alfred Marshall, who wrote: "The most valuable of all capital is that invested in human beings ...."<sup>3</sup> Interestingly, he went on to say, "...and of that capital the most precious part is the result of the care and influence of the mother, so long as she retains her tender and unselfish instincts, and has not been hardened by the strain and stress of unfeminine work." [Ibid.] The first part of this quote has

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<sup>2</sup> Adam Smith, An Enquiry into the Nature and Causes of the Wealth of Nations, 5th edition, 1776 (Random House Modern Library Edition, 1937).

<sup>3</sup> Alfred Marshall, Principals of Economics, 1890 (8th Edition, MacMillan, New York, 1948).

been cited often by students of Human Capital; the second part has been strangely ignored.

### 1.1. What is the Theory of Human Capital?

The basic idea of Human Capital Theory is strikingly simple. It is that improvement in human productive capacity is fully as feasible as increasing productivity by adding machines and other physical assets.

Think for a moment about physical capital; it consists of tools and trucks, buildings and bulldozers, railways, runways and roads. In short, it consists of stocks of many different useful things that share several attributes. First, they are produced by man to help him to produce other things that he wants; they are not wanted for their own sakes but because they are useful instruments that multiply man's power to get things he wants - it is this instrumental role that distinguishes capital from consumption goods. Second, it is the services that flow from the stocks of physical capital goods that are used in production, not the stocks of goods themselves; a hydro-electric station is used, not used up - it is this that distinguishes capital from material which is consumed or transformed in the process of production. Third, physical capital may wear out because of physical deterioration and it may obsolesce because newer and

more efficient capital becomes available. Fourth, by investment, the stock of physical capital may be maintained and increased; by saving from current income, i.e., by not consuming all that is produced, some current production can be devoted to increasing the stock of physical capital. Finally, once created, the value of a piece of capital stock (a computer, for example) ceases to bear any necessary relation to its original cost of production; its value is derived from the value of what can be produced with its aid.

Think now about the analogies between physical capital and human productive capabilities. Begin by acknowledging that good health, knowledge and other useful human qualities are wanted for their own sakes as well as for whatever usefulness they may have in producing income, goods and services. In other words, these qualities have something of the character of durable consumer goods which directly furnish their owners with pleasure and utility. Nevertheless, they often do increase their owners' productive capacities above what those might be if the good health, knowledge, etc. were absent. So we can conceive of these capacities as stocks of useful stuff which can be augmented by investment in health care, training and education. Alas, the stocks can also be depleted by sickness, injury and age as well as through obsolescence stemming from advancing technology which renders older knowledge and skill less useful.

Now take the analogy a step farther. If human qualities can provide flows of useful services, we can permit ourselves to ask: What is the worth of a given endowment of these qualities? Ideally, just as in computing the value of a machine, we should obtain data on the value of the stream of useful goods and services that the endowment can be expected to produce over its useful life; by discounting, we should be able to estimate the present value of the human capital quite analogously to that of any other asset.

If you have gone this far with the analogy, it is easy to keep going. If knowledge is a valuable asset to the person having it, how much more valuable is a given increase in his knowledge? Asking it differently: What is the rate of return to a particular person of investing in his further education? Taking a societal rather than an individual viewpoint: What is the economic payoff to a society of a given increment in its educational investment? What is the dollars and cents contribution of improving the health of the working population? What is the expected net economic worth to a society of admitting an immigrant with a particular set of qualifications? How much is lost from a brain drain of such and such a magnitude?

Look now at the marketplace surrounding human capital formation. How are investment decisions made? On the basis

of what objectives and information do individuals decide to alter their stocks of human capital? How does this decision process differ from that which applies to physical capital investment decisions? How can these differences be expected to affect the optimality of private and public decisions concerning investment in human capital? How adequate are financial institutions to provide funds for this investment? How are the returns from investment in human capital distributed in society? In particular, what portion of the economic returns from investment in a particular human being can be expected to redound directly to that person and what portion will spill over to the benefit of other members of society? How does this distribution of net benefits affect people's willingness to invest and what does it imply for a rational policy of public investment in human capital?

Broadly defined, the Theory of Human Capital is a body of conceptual and empirical knowledge based on the extension of capital theory beyond the realm of physical assets into the domain of human qualities and attributes. The preceding paragraphs give the flavour of the questions that agitate students of the subject. As an independent area of inquiry, it is very young although it borrows liberally from the parent body of economic theory and method. The progress of its development is hampered by difficulties, the most serious

of which surround the acquisition of empirical data of quality and quantity sufficient to adequately test alternative hypotheses and to construct useful models. Investigators in this field have confronted its inherent difficulties with impressive ingenuity and resourcefulness. Nevertheless, they typically have been forced to make very heroic assumptions and to build their work on shaky theoretical underpinnings. To their credit, the contributors to this field have usually surrounded their conclusions with suitable caveats - many of which have been ignored by less cautious consumers of those conclusions who have found the qualifications inconvenient to the grinding of policy axes.

We turn now to a critical examination of some specific parts of the human capital literature that are, or have been, regarded as being most relevant to the formation of public policy in the field of education.

#### 1.2. Human Capital Formation and Economic Growth

Beginning just after the end of World War II, an epidemic of virile growthomania swept over the politicians and professional economists of the world. By the mid-1950's, it seemed that nobody was immune to the infection. The growth of interest in human capital theory began as a minor complication of the more serious disease. The sources and causes of economic growth were then even more poorly understood than they are today.

Classical growth theory, if one may speak of such a thing, attributed economic growth mainly to increased inputs of the "factors of production" - land, labour and capital - into the productive processes of a nation. But even casual observation of the vastly differing postwar growth experiences of various countries aroused doubt about the adequacy of this classical explanation. Could, for example, the rapid economic recoveries of Germany and Japan and the continuing economic stagnation of most under-developed countries be explained solely by differences in the rates of capital investment and numerical growth of the labour force? It seemed unlikely. There had to be something else at work. Various conjectures were put forth about the roles of research and development, political stability, technological innovation, cultural heritage, etc. But a prominent "something else" was thought to be the improvement in the quality of the labour force.

In the late 1950's and early 1960's, a series of measurements by Abramovitz<sup>4</sup>, Solow<sup>5</sup>, Fabricant<sup>6</sup> and Kendrick<sup>7</sup>

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<sup>4</sup> M.Abramovitz, "Resource and Output Trends in the U.S. since 1870," American Economic Review, May 1956, Volume 46, No.2, pp.5-23.

<sup>5</sup> Robert Solow, "Technical Change and the Aggregate Production Function," Review of Economic Statistics, August 1957, Volume 39, No.3, pp.312-320.

<sup>6</sup> S.Fabricant, Basic Facts on Productivity Change, Columbia University Press, New York, National Bureau of Economic Research, 1959.

<sup>7</sup> J.Kendrick, Productivity Trends in the United States, Princeton University Press, Princeton, New Jersey, National Bureau of Economic Research, 1961.

demonstrated that the historical growth of conventionally measured inputs, capital and labour, failed to explain a large portion of the historical growth in U.S. national income. There had been, in short, an increased productivity of the factors of production that somehow accounted for the "residual" between the observed total growth of output and that growth attributable to quantitative growth in the conventional inputs. Kendrick<sup>8</sup> found that the U.S. economy grew at the average annual rate of 3.5 per cent per annum over the period between 1889 and 1957; over the same period, the index of total factor input (i.e., conventionally measured labour and capital summed together using weights derived from their relative shares in the total GNP) grew by only 1.9 per cent per annum. The "residual", or the "increase in total factor productivity" is found by subtraction to be 1.6 per cent per annum; in other words, some 46 per cent of the growth is ascribed to the residual! In a more recent study, Kendrick<sup>9</sup> estimated that the annual rate of growth of total private output in the U.S. economy increased from 2.8 per cent during 1919-1948 to 4.0 per cent during the years 1948-1966. During the entire period 1919-1966, he estimated that total factor productivity (the "residual") increased by about 2.1 per cent per year. Basing himself on Solow's methodology,

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<sup>8</sup> Ibid., p.8.

<sup>9</sup> J.Kendrick. Postwar Productivity Trends in the United States, New York, National Bureau of Economic Research, 1970, mimeo.

which differs somewhat from Kendrick's, Massell<sup>10</sup> found the residual to be about 90 per cent of the increase in output per man-hour in the U.S. economy during the period 1915-1955.

Few economists were content to attribute a major part of the U.S. economic growth to a faceless and nameless "residual" which is, as Abramovitz<sup>11</sup> aptly noted, a "measure of our ignorance." The search was soon on for the underlying factors responsible for the increase in total factor productivity. Nadiri<sup>12</sup> provides a review of the problems and progress along the road to discover the sources of the residual.

One of the most persistent and influential contributors to the literature on the sources of economic growth has been Edward F. Denison of the Brookings Institution. A book published in 1962<sup>13</sup> sought to find as full an explanation as possible for the unexplained "residual" in U.S. economic growth. To the

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<sup>10</sup> B. Massell, "A Disaggregated View of Technological Change," Journal of Political Economy, December 1961, 69(6), pp. 547-557.

<sup>11</sup> Abramovitz, "Resource and Output Trends," p.8.

<sup>12</sup>

M.I. Nadiri, "Some Approaches to the Theory and Measurement of Total Factor Productivity: A Survey," The Journal of Economic Literature, December 1970, Volume VIII, No.4, pp.1137-1177.

<sup>13</sup>

E.F. Denison, The Sources of Economic Growth in the United States and the Alternatives Before Us, Supplementary Paper #13, Committee for Economic Development, New York, 1962.

conventional measures of labour and capital inputs, he added variables in his equation to represent changes in labour quality due to formal education, increased experience and better utilisation of female workers, changed age-sex composition of the labour force and others. To adjust for changes in labour quality due to formal education, Denison used weights derived from data on earning differentials by level of education, i.e., an estimate of the direct returns to education which method is discussed in detail below. The observed differentials in earnings were adjusted downward by 40 per cent to allow for differences in ability, motivation, etc., which Denison presumed to be associated with earnings differentials.

Denison's results were dramatic. For the period 1929-1957, his calculations attributed 23 per cent of all growth in U.S. real national income to education. He estimated that education was responsible for some 42 per cent of the growth of worker productivity. Remarkable! Denison's results found an eager readership in the intellectual community of the United States, Canada and Western Europe.

Only three months before Denison's results were published, the Organisation for Economic Co-operation and Development sponsored a Conference on Economic Growth and Investment in Education at the Brookings Institution in Washington. The pièce de resistance of this conference was a paper by Svennilson (Sweden), Edding (Germany) and Elvin (United

Kingdom)<sup>14</sup>. In it, the authors correlated enrolment ratios and per-capita GNP from twenty-two countries of Europe and North America. They discovered, too, not surprisingly, a positive relationship. To their credit, they cautiously avoided drawing the conclusion that the higher enrolment rates had caused the higher per-capita GNP; they contented themselves with the recommendation that certain European members of the OECD could and ought to afford increased levels of spending on education because they lagged behind.

In 1965, the Economic Council of Canada published a study by Gordon W. Bertram entitled The Contribution of Education to Economic Growth which was an application to Canadian data of a methodology very similar to Denison's. For the period 1911-1961, Bertram attributed to education roughly 25 per cent of the growth in average real income per person in the male labour force. For the purposes of comparison, Bertram computed the contribution of education for the period 1929-1957 (the period covered by Denison) and found it to be 20 per cent of the production growth per employee, or less than half the U.S. figure as computed by Denison.<sup>15</sup>

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<sup>14</sup> I.Svennilson, F.Edding and L.Elvin, "Targets for Education in Europe in 1970", Policy Conference on Economic Growth and Investment in Education, October 16 - 20, 1961, OECD, Paris, 1962.

<sup>15</sup> G.W.Bertram, The Contribution of Education to Economic Growth, Staff Study #12, Economic Council of Canada, Ottawa, Queen's Printer, 1965.

The studies of Denison, Bertram and other economists were taken seriously, even literally, by policy makers in the United States, Canada and Europe. President Kennedy, in his message to Congress on Education on January 29, 1963 said:

This nation is committed to greater investment in economic growth; and recent research has shown that one of the most beneficial of all such investments is education, accounting for some 40 per cent of the nation's growth in productivity in recent years. It is an investment which yields a substantial return in the higher wages and purchasing power of trained workers, in the new products and techniques which come from skilled minds, and in the constant expansion of this nation's storehouse of useful knowledge.

The Economic Council of Canada, in its Second Annual Review published in December, 1965 stated:

Very considerable scope would appear to exist in Canada to promote the growth of average per capita income by improving the educational stock of the labour force. The accumulating evidence and analysis suggest that the benefits from such improvements can be substantial for both the individuals and the economy as a whole. ... Much of the benefit will be experienced in a prolonged and cumulative way over a period of several decades. But the benefits ultimately will be large. This reinforces the need for sustained and unflagging efforts to strengthen and extend the educational base for long-term future growth of the economy and the living standards of Canadians.

What can be said by way of evaluation of the efforts of Denison, Bertram and others to use aggregative production

functions as a means of estimating the contribution of education (or other factors, for that matter) to economic growth? How seriously should we take: (1) their conclusions that education has been a significant factor contributing to the improvement of the quality of the labour force and, therefore, to economic growth in Canada and the United States. (2) The specific numeric estimates of the magnitude of education's contribution? Our conclusion is that all of this work supports the hypothesis that education has made a positive contribution to economic growth but that the specific numeric estimates of that contribution made by Denison, Bertram and the others ought not to be taken too seriously. Why these conclusions?

First, the very notion and existence of an "aggregate production function" is open to serious doubt. This means that Solow, Kendrick et al. who pioneered the empirical work in measuring total factor productivity as well as Denison, Bertram and others who have tried to explain the "residual", are vulnerable to the criticism that their work is based on an ephemeral substantive foundation. The idea of a production function as it is used in micro-economics is understood to be a mathematical equation describing the boundary between a set of feasible input-output combinations and a set of unfeasible ones; it describes the locus of all Pareto optimal outputs obtainable from varying but specific combinations of inputs with a specific technology. As

such, it abstracts important information about some real, observable phenomenon; it is grounded, so to speak, in reality. But the aggregate production function is quite another thing; there is no real, observable, optimising entity underlying it. As Nelson<sup>16</sup> has noted, it is based on sheer abstraction. Nadiri<sup>17</sup> recently put it this way:

Serious questions have been raised about the existence of the aggregate production function. On the other hand, the nature of the function, i.e., the magnitude and stability of its parameters, is not yet established unequivocally, leading to strong doubts about its usefulness for empirical research even as an accounting framework. [p. 1169]

Second, even if we accept the notion of an aggregate production function as a valid one for empirical investigation, the work of Denison and Bertram can be criticised for their failure to adequately treat improvements in physical capital or the complementarities between physical capital, human capital and technological change. The manner in which the investigator chooses to handle these things expresses itself in the specification of the functional form of the equation that he estimates. Unfortunately, the numeric estimates of the relevant

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Richard R.Nelson, Comments on Griliches' paper, "Notes on the Role of Education and Production Functions and Growth Accounting", in W.L.Hansen (ed.), Education, Income and Human Capital, Columbia University Press, New York, 1970, pp.124-127.

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M.I.Nadiri, "Some Approaches to the Theory and Measurement of Total Factor Productivity: A Survey", p.10.

coefficients are very sensitive to the specification of the equation, to the types of data used and to the methods of estimation employed. They are so sensitive, indeed, that they can hardly provide concrete quantitative figures about the contributions of various factors to the growth of output.<sup>18</sup>

Third, the validity of any statistical estimating technique depends on the acceptance of certain convenient assumptions pertaining to the stochastic properties of the underlying system which the model purports to explain. These assumptions are difficult to verify in nearly all economic models but in aggregative growth models, they absolutely defy verification.<sup>19</sup>

Finally, there is almost certainly a strong element of mutual dependence in the relation between education and economic growth. Intuitively, it does seem reasonable to think that economic growth is influenced by the quality of the labour force which, in turn, is influenced by educational expenditures, years of schooling, etc. It also seems reasonable to think that educational expenditures depend, in part, upon the affluence of a society, i.e., on its income. Which is the chicken and which the egg? And which came first? Poultrymen probably have

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<sup>18</sup> M.I.Nadiri, "Some Approaches to the Theory and Measurement", p. 10.

<sup>19</sup> W.Leontief, "Theoretical Assumptions and Non-Observed Facts", American Economic Review, March 1971, Volume LXI, No.1, pp.1-7.

their own answers to those questions but an economist has to worry about biased estimation when mutual dependency exists among his variables. A recent study<sup>20</sup> has shown what a distorting effect the mutual dependency between income and education has on the estimation of the contribution made by education to economic growth. The single equation estimate of the elasticity of income with respect to education expenditures, which is equivalent to assuming a uni-directional causal relation between the two variables, turned out to be about four times higher than the estimate based on a two-equation model which recognised the mutual dependency! This finding is very damaging to the specific numeric results obtained by Denison and Bertram.

Since the publication of Denison's work in 1962, other scholars have attempted to determine the contribution of education to economic growth by working with less aggregative models. The work of Zvi Griliches stands out for its high quality. He constructed econometric production functions using regional data for U.S. agriculture and manufacturing industries. In addition to variables representing livestock, machinery inputs, fertiliser, etc., Griliches included variables for labour and

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20 G.S.Tolley and E.Olsen, "The Interdependence between Income and Education", Journal of Political Economy, May/June 1971, Volume 79, No.3, pp.460-480.

education of the labour force in his agricultural production function. His manufacturing production function included labour, education and non-human capital as independent variables. His findings support the relevance of the education or labour quality variables; they are significant at conventional statistical levels and their coefficients are not significantly different from the coefficients of the conventional labour input measures.<sup>21</sup>

Here are the main conclusions of this section:

(1) More than a decade's work with aggregate production functions has produced much evidence of a positive causal relationship between education and economic growth. (2) Limitations of the data have prevented economists from developing quantitative estimates of that relationship which will withstand searching examination. (3) The earlier estimates of education's contribution to economic growth were accepted rather uncritically by non-economists.

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- 21 Z.Griliches, "Estimates of the Aggregate Agricultural Production Function from Cross-Sectional Data", Journal of Farm Economics, Volume 45, No.2, 1963.
- Z.Griliches, "Production in Manufacturing: Some Preliminary Results," in M.Brown (ed.), The Theory and Empirical Analysis of Production, Studies in Income and Wealth, Volume 31, Princeton University Press, New York, National Bureau of Economic Research, 1967.
- Z.Griliches, "Production Functions in Manufacturing: Some Additional Results," Southern Economic Journal, Volume 35, No.2, 1968, pp.151-156.
- Z.Griliches, "Notes on the Role of Education and Production Functions and Growth Accounting," in W.L. Hansen (ed.), Education, Income and Human Capital, Columbia University Press, New York, 1970, pp.71-115.

### 1.3. The Returns to Investment in Human Capital

A second main stream of empirical work in the economics of human capital has been the measurement of the public and private returns to educational expenditures as a form of investment in human capital. The literature here is very large and no attempt will be made to survey it exhaustively. Instead, we will begin by laying out the methodology of this research, proceed to discuss the most interesting and important empirical results, assess the problems and criticisms of this work, and produce, finally, an overall evaluation.

#### 1.3.1. The Methodology

The methodology of estimating the net returns to investment in education can best be understood if, for the purpose of exposition, we direct our attention to a model of the decision process that might be followed by an individual. It will be obvious from his hypothesised behaviour that this so-called individual is an ideal type, a perfectly calculating, utility maximising being.

Suppose we have a person whom we observe at some particular point in his life; for the sake of the story, say that we encounter him late in his secondary school career at the time when he is trying to make up his mind whether to

continue his education. Suppose that he is dreadfully mundane in his aspirations and wishes to make a decision that will maximise the monetary value of his lifetime earnings. To make things really simple, suppose that he has the choice (1) of continuing his education by going to university or (2) of going to work immediately. If he chooses the latter course, that of taking a job now, he can look forward to immediate income from employment and from a stream of earnings stretching out into the future each pay-day until he leaves the labour force. If, on the other hand, he decides to go to university, he must reckon that he will have to forego all or part of the income that he might have enjoyed from employment during the period that he will be in school. These foregone earnings are sometimes called opportunity costs by economists. Furthermore, he will have to pay tuition fees and other expenses that he could avoid if he were not to go to school. After his graduation, however, he will anticipate gainful employment for the duration of his working years and, consequently, a stream of earnings stretching off into the future.

In order to focus attention on the crux of the decision problem faced by our avaricious young man, assume that he is in possession of full and accurate information about a lot of things that no real person ever knows for sure. For example, assume that he knows exactly what he would earn in each future

time period of either of the alternatives which he is considering; assume equal prescience about all future costs connected with his further education that would be avoided in the other case. Assume, finally, that he knows with certainty that he will complete his college education if he, in fact, begins it.

Our money-maximising young investor in human capital must then do some calculations. His first step is to subtract from the earnings that he anticipates if he completes college, the sum of anticipated earnings if he does not plus the additional, unavoidable expenses associated with attending college. He must perform this subtraction for each future time period; say that he does it on an annual basis for every year that he will be in the labour force. The result is a stream of net earning differentials associated with his decision to attend (and complete) university. Now he can do three things: (1) He can simply add up this stream to produce a sum of the net earnings differentials for all years. This may satisfy his curiosity to know by how much his lifetime earnings would be increased if he chooses to go to university, but it is really not of much use for the purposes of deciding whether that is or is not a good thing to do. (2) He can choose some rate of interest that he thinks is appropriate and discount the stream of earning differentials back to their present value. This is just the sort of thing that he might do if he were thinking of buying a new asset of any other kind. The discounting

of future earnings differentials would be done by a sophisticated investor because (i) future income is less valuable to him than having the money at present and (ii) the investment in education (human capital formation) could have been placed in other assets (securities or real estate, for example) that would provide an annual return and, perhaps, a capital gain when sold. (3) He can solve for that rate of interest, which, if applied as a discount rate to the stream of earning differentials, would produce a net present value of exactly zero; this is called the internal rate of return.

Many people will make more sense of all this if it is expressed symbolically.

Let:

$e_{it}$  be the earnings in year  $t$  if the young man completes education type  $i$ .

$i = \begin{cases} 1 & \text{if he does not attend and complete university} \\ 2 & \text{if he does attend and complete university.} \end{cases}$

$t = 0, 1, \dots, T$  where 0 indicates this year, etc., and  $T$  stands for the final year that he is in the labour force.

$c_{it}$  be the costs that are uniquely associated with education type  $i$  in year  $t$ .

Then the streams of net earnings associated with the two alternatives are:

$$(1) \quad (e_{11} - c_{11}) ; (e_{12} - c_{12}) ; \dots ; (e_{1T} - c_{1T})$$

for the case in which he terminates his education at the end of high school.

$$(2) \quad (e_{21} - c_{21}) ; (e_{22} - c_{22}) ; \dots ; (e_{2T} - c_{2T})$$

for the case in which he attends and completes college.

Now the sum of the earning differentials is given by (3)

$$(3) \quad D = \sum_{t=0}^{t=T} (e_{2t} - c_{2t}) - (e_{1t} - c_{2t})$$

The present value of the stream of earning differentials is computed as in (4)

$$(4) \quad P = \sum_{t=0}^{t=T} \frac{(e_{2t} - c_{2t}) - (e_{1t} - c_{2t})}{(1 + r)^t}$$

Where  $r$  is the rate of discount.

Finally, the internal rate of return is found by solving (4) for that rate of discount,  $r = r^*$ , which produces a zero present value, i.e.,  $P = 0$ .

Now since our young man is supposed to be a very sophisticated investor, he also will have computed the present value and, doubtlessly, the internal rate of return for all his other investment opportunities. He should then rank them along with his college educational "investment opportunity"

in descending order of their internal rates of return. He should then begin at the top of the list and decide to undertake as many of the investment opportunities as he has the funds to support, providing, of course, that all opportunities undertaken must have a positive internal rate of return. If he has a limited supply of investable funds, then we may expect that he will have to forego some opportunities; whether he decides to go to college or not will depend on whether the internal rate of return to investment in his university education is below the cutoff investment opportunity, i.e., the last one to be "funded" and undertaken. If it is below the cutoff, our young man will go to work rather than to university; otherwise he will continue his education.

This model of the individual investment decision process is sufficiently robust to tolerate the relaxation of most of the simplifying assumptions that were made. Our investor need not have perfect knowledge of future earning streams; it is sufficient only that he should have a mathematical expectation, i.e., that he can associate a level of probability with all possible amounts of future income in each time period. Similarly, he needs only to know the probability of completing his university education. With these and some other probabilities, he can compute the expected value of his future earning streams. He can proceed then to maximise the

overall expected rate of return from all of his investment analogously with the case of perfect certainty outlined above.

It is not necessary that this description of "perfectly rational" investment behaviour should be a faithful representation of what any real person would actually do; as a positive or predictive model, it is sufficient that significant groups of people behave as if it were such a representation; as a normative model of the calculations that a person should do if or to the extent that he were interested in maximising the value of his capital (both human and non-human)stock, it stands on the merits of its internal logic.

In any case, what interests us here is that this model of individual investment behaviour has been used as the conceptual foundation for a series of measurements of the returns to investment in education. As mentioned previously, there have been a great many of these studies in the last few years but no discussion of them is possible without mentioning the outstanding research of Gary Becker of the National Bureau of Economic Research. Becker's contribution to the literature began in 1960 and has continued to the present; his book, Human Capital (1964) stands as a monument to the application of rigour in empirical economics.<sup>22</sup>

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<sup>22</sup> Gary S. Becker, "Underinvestment in Education", American Economic Review, Vol.50, May 1960, pp.346-54.

continued

Another pioneer in this field has been Jacob Mincer of Columbia University.<sup>23</sup>

The extension of the individual investment model is straightforward; define several groups of people who differ, among other things, in the amount of education that they have. The standard of comparison is frequently taken to be the members of the labour force with a completed high school education;

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22 cont.

G.S.Becker, "Investment in Human Capital: A Theoretical Analysis," Investment in Human Beings, National Bureau of Economic Research Special Conference 15, Supplement to Journal of Political Economy, October 1962.

G.S.Becker, Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Columbia University Press, 1964.

G.S.Becker and B.R.Chiswick, "Education and the Distribution of Earnings," American Economic Review, May 1966.

23

Jacob Mincer, "Investment in Human Capital and Personal Distribution of Income," Journal of Political Economy, Vol.66, August 1958, pp.281-302.

J.Mincer, "On the Job Training Costs, Returns and Some Implications," Journal of Political Economy, Supplement, October 1962.

J.Mincer, "Schooling, Age, and Earnings," in Human Capital and Personal Income Distribution, National Bureau of Economic Research (in progress), 1969.

J.Mincer, "The Distribution of Labour Incomes: A Survey with Special Reference to the Human Capital Approach," Journal of Economic Literature, Vol.VIII, No.1, March 1970, pp.1-26.

the differential earnings of other groups are computed with respect to the average earnings of those with high school education. The next step is tricky; it is to assume that the cross sectional earning differentials (among groups with different educational attainments) taken across all age groups at a single point in time constitutes a good proxy for the longitudinal differentials that will develop in time among members of a specific age cohort.

To illustrate this point, suppose that we were trying to estimate the economic value of further education for the cohort of people who completed high school in June, 1971; call them the Class of '71. To simplify the exposition, we will assume that these people are, on the average, 19 years of age. Now we would really like to know what will be the average earnings of members of the Class of '71 with a completed high school education and with a university degree in 1972, 1973, ...., 1984, ... etc. If we knew these things (plus, incidentally, the average cost in each future year to the students of obtaining their degrees) we could easily compute the earning differentials for members of the Class of '71 for each year into the future.

Obviously, we cannot know what these future earnings are going to be. So we must approximate the future from what we know about the present. We would do this by assuming that the average earning differential between, say, 25-year-olds with a college degree and 25-year-olds with high school education in 1971 is a good approximation to the differentials that will have

emerged by 1977 between those members of the Class of '71 who will graduate from college and those members who will not go beyond high school.\* The same correspondence is assumed between those who are 30 in 1971 and the members of the Class of '71 when they reach the age 30 in 1982, and so on for all pairs of future years and present age groups.

Once the stream of future earning differentials has been approximated by using the cross sectional earning differentials from some recent year, the procedure is simply to compute the net present values and/or internal rates of return for various kinds of educational investments. Two points of view are often taken; (1) that of the private individual and (2) that of society. Depending upon which vantage is chosen, certain elements of cost, subsidies and taxes and are included or excluded.

If the private point of view is taken, we are really asking what it is worth to an individual to increase his or his family's investment in his education. If this is the case, we include in the costs only those borne by the individual and his family. This would include all out-of-pocket costs that students, on the average, incur in getting their further education, e.g., tuition charges, fees, book

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\* Note that people who are 19 years old in 1971 will be 25 years old in 1977.

purchases, etc. It would also include the average value of whatever earnings may have to be foregone in the process of obtaining the additional education. Any public or private subsidy to education would be excluded from the private reckoning of costs. On the earning side, the future income is taken after the application of income taxes. The rate of return calculation is then made on the streams of private costs and incomes to furnish an estimate of the value of various kinds of private educational investment.

From the public or societal point of view, the cost figures desired are the total social costs; the private costs are therefore increased by the amount of any public or private subsidy. This subsidy should include not only actual expenditures but also hidden subsidies that may be made to education in the form of reduced taxes on educational institutions, foregone earnings on institutional lands and buildings, etc. Earnings, on the other hand, should be taken gross of income taxes. The internal rate of return from social investment in education can be compared with the rates of return from other areas of social expenditure.

### 1.3.2. Some Empirical Results

In his 1964 book, Becker presents the results of his study of the rate of return to educational investment in the

United States for the cohorts graduating from college in 1939, 1949, 1956 and 1958. His findings were that the private rate of return to investment in college education were very considerable, on the order of 13 to 14 per cent per annum. The rate was higher for urban, male college graduates and lower to college drop-outs, non-whites, females and rural residents. Becker estimated that the private rate of return to investment in high school education increased from about 16 per cent in 1939 to 28 per cent in 1959. Table 1 summarises his results.<sup>24</sup>

TABLE 1

PRIVATE RATES OF RETURN FROM COLLEGE AND HIGH-SCHOOL EDUCATION FOR SELECTED YEARS 1939, USA (per cent)

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Year of Cohort	College Graduates	High School Graduates
1939	14.5	16
1949	13+	20
1956	12.4	25
1958	14.8	28

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Source: G.S.Becker, Human Capital, p.128.

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<sup>24</sup> G.S.Becker, Human Capital, p.26.

Table 2 presents results obtained by other American economists that are generally comparable in magnitude with Becker's estimates.

TABLE 2  
SOME ESTIMATES OF RETURNS TO INVESTMENT  
IN COLLEGE EDUCATION, USA, Males

	Hansen 25	Miller 26	Schultz 27	Becker 28
Discount Rate %	5	5	5	5
Net Present value *				
private, before tax	23,500	31,600		
private, after tax	16,700	22,500	8,000	
social			10,000	
Benefit Cost Ratio				
private, before tax				
private, after tax				
social				
Internal Rate of Return				
private, before tax	11.6			
private, after tax	10.1			
social	10.2			

\* All figures adjusted to 1968 dollars and discounted to age 19 at five per cent per annum

25 W.Lee Hansen, "Total and Private rates of Return to Investment in Schooling," Journal of Political Economy, Vol.LXXI, April 1963, pp.128-40.

TABLE 3

SOME ESTIMATES OF RETURNS TO INVESTMENT  
IN COLLEGE EDUCATION, CANADA, Males

	Stager 28	Drummond 29	Podoluk 30	Wilkinson 31	Dodge 32
Discount Rate %	5	5	5	5	5
Net Present value <sup>#</sup> private, before tax private, after tax social	26,000 28,600		27,000 20-21 000		12,700
Benefit Cost Ratio private, before tax private, after tax social	4.5 3.3		4.9 3.8 2.6		
Internal Rate of Return private, before tax private, after tax social	15.4 12.5		19.7 17.5		12.2 9.2

\* All figures adjusted to 1968 dollars and discounted at 5% rate to the age 19.

26 Herman P. Miller, "Annual and Lifetime Income in Relation to Education: 1939-1959," American Economic Review, Vol. L, December 1960, pp. 962-86.

27 T.W. Schultz, "Capital Formation by Education," Journal of Political Economy, Vol. LXVIII, December 1960, p. 580.

Several Canadians have studied the returns to educational investment in Canada and Table 3 presents some summary indicators of their results. More recent Canadian work has focussed the analysis at a more disaggregative level of the returns to specific programmes of post-secondary education. David Stager of the University of Toronto and Systems Research Group (SRG) have concentrated their work on the returns to educational investment in Ontario. Tables 4 to 6 present some of their results.

Both the Stager and the SRG studies make adjustments for mortality, labour force participation, and the contribution of student ability to earning differentials. On the matter of ability, Stager assumed that one-third of earning differentials

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- 28 David A. Stager, Monetary Returns to Post-Secondary Education in Ontario, unpublished dissertation, Department of Economics, Princeton University, May 1968.
- 29 Ian Drummond, "Labour Markets and Educational Planning," in Arthur Kruger and Noah M. Meltz (eds.), The Canadian Labour Market, Centre for Industrial Relations, University of Toronto, Toronto, 1968, pp. 243-295.
- 30 J.R. Podoluk, Earnings and Education, Census Monograph Series, No. 91-510, Queen's Printer, Ottawa, 1965.
- 31 Bruce W. Wilkinson, "Present Values of Lifetime Earnings for Different Occupations," Journal of Political Economy, Vol. LXXIV, December 1966, pp. 556-72.
- 32 David A. Dodge, "Economic Returns to Investment in Education in Ontario," unpublished B.S. thesis, Queen's University, Canada, 1965.

could be attributed to that factor while SRG assumed two-fifths. The two studies are comparable in methodology except on two points: (1) The SRG study went considerably farther than Stager to include the hidden subsidies extended to post-secondary institutions in the form of municipal services, the opportunity cost of institutional plant and equipment, etc. (2) SRG assumed that economic growth would continue and that all incomes would grow at a rate of 2.7 per cent per annum in the future. The results are not particularly sensitive to the first factor but they are to the second; the rates of return as computed by Stager should be increased by about one-half to make them comparable to the SRG results in which the annual growth in real per-capita income is assumed to be 2.7 per cent.\*

From the Stager and SRG studies flow some very significant conclusions. Among the most important of these are the following:

- (1) Some of the private rates of return are very high. Obviously, with whatever else students may get with their education, they also are receiving an economic asset of considerable worth.

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\* The adjustment is not uniform for all programmes because of the varying shapes of the differential earning streams appropriate to each individual programme (occupation).

TABLE 4

STAGER'S ESTIMATES OF THE SOCIAL AND PRIVATE RETURNS  
TO EDUCATION BEYOND HIGH SCHOOL, MALES, BACHELOR AND  
FIRST PROFESSIONAL DEGREES<sup>1</sup>, ONTARIO, 1961

Alternative Assumptions	Discount Rate:	Net Present Values <sub>2</sub>			Benefit/Cost Ratio		Internal Rates of Return
		0%	5%	10%	0%	5%	
<u>Social Returns</u>							
1. Assuming 100 per cent of income differential due to education alone		\$128,000	\$28,600	\$4,500	10.1	3.3	1.4
2. Assuming 67 per cent	79,300	14,300	-1,100	6.6	2.1	0.9	9.4
3. Assuming 60 per cent	69,300	11,300	-2,300	5.9	1.9	0.8	8.6
<u>Private Returns<sup>3</sup></u>							
1. Assuming 100 per cent of income differential due to education alone	103,600	26,000	6,400	13.3	4.5	2.0	15.4
2. Assuming 67 per cent	66,500	14,600	1,800	8.8	2.9	1.3	11.7
3. Assuming 60 per cent	60,200	12,800	1,000	8.0	2.7	1.2	11.0

1. Average for all Faculties, weighted by number of degrees granted in each Faculty, Ontario Universities, 1962-63.
2. Rounded to nearest 100 dollars.
3. After income tax deductions.

Source: David A. Stager, Monetary Returns to Post-Secondary Education in Ontario, unpublished dissertation, Department of Economics, Princeton University, May 1968, p.149.

TABLE 5  
 STAGER'S ESTIMATES OF THE SOCIAL AND PRIVATE RETURNS  
 TO EDUCATION BEYOND HIGH SCHOOL IN THE EXISTING  
 PATTERN, ONTARIO, 1961.<sup>1</sup>

Faculty or Institution	Net Present Values <sup>2,3</sup>		Benefit/Cost Ratios <sup>2</sup>		Internal Rates of Return	
	Social	Private	Social	Private	Social	Private
<b>Males: University</b>						
1. Dentistry	\$52,800	\$51,000	3.6	6.3	16.9%	23.7%
2. Medicine	45,700	42,500	3.0	4.7	11.5	14.8
3. Law	26,400	23,900	2.4	2.9	10.0	11.5
4. Commerce and Business	19,400	18,200	2.6	3.4	11.5	14.5
Administration						
5. Arts and Science	18,600	16,700	2.7	3.2	11.5	13.3
6. Architecture	14,500	15,100	1.8	2.5	8.6	10.9
7. Engineering	12,500	14,000	1.9	2.8	9.0	12.5
8. Pharmacy	11,700	13,800	1.8	2.8	9.0	13.1
9. Veterinary Medicine	11,100	15,600	1.5	2.8	7.5	13.1
10. Forestry	10,000	11,800	1.7	2.5	8.2	11.5
11. Agriculture	4,600	8,900	1.3	2.3	6.9	11.6
12. Music	3,100	7,100	1.2	1.9	6.2	9.6
13. Education	2,400	4,200	1.1	1.4	5.9	7.3
14. Physical and Health Education	1,200	4,200	1.1	1.4	5.4	7.2
15. Social Work	-9,500	-6,900	0.3	0.3	-0.7	-1.0
16. Theology	-33,200	-24,900	a	a	a	a

TABLE 5 (continued)

<u>Males: Non-degree Institutions</u>					
1.	Institutes of Technology	\$3,500	\$4,300	1.5	2.0
2.	Teachers Colleges	2,100	3,000	1.4	3.1
3.	Provincial Schools	1,400	2,500	1.2	1.6
<u>Females: University</u>					
1.	Physical and Occupational Therapy	-1,200	1,900	0.9	1.4
2.	Household Science	-1,500	4,700	0.9	1.8
3.	Nursing	-1,700	4,300	0.9	1.8
4.	Social Work	-4,100	-600	0.7	0.9
<u>Females: Non-degree Institutions</u>					
1.	Teachers Colleges	11,000	11,500	6.2	11.3
2.	Private Business Colleges	4,300	3,600	3.5	2.8
3.	Nursing Schools	-600	2,700	0.9	1.9

1. Assuming that 67 per cent of the earnings differential can be attributed to further education.  
 2. Using a discount rate of 5 per cent.  
 3. Rounded to nearest 100 dollars.  
 a. Computation of a benefit/cost or an internal rate of return is meaningless because the earnings differential is negative for each year.

Note: See Note at bottom of Table IV: 3.

Source: David A. Stager, Monetary Returns to Post Secondary Education in Ontario, unpublished dissertation, Department of Economics, Princeton University, May 1968, p.173.

TABLE 6.A

SRG's ESTIMATES OF SOCIAL AND PRIVATE  
RETURNS BY PROGRAMME, MALES, ONTARIO  
1968-69<sup>1</sup>

PROGRAMME	PRIVATE			SOCIETAL		
	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO
Dentistry	56.50	95,348	8.14	19.59	103,646	2.95
Vet. Medicine	36.57	35,291	4.83	9.84	16,731	1.37
Social Work	30.53	8,455	2.28	9.73	3,346	1.20
Agriculture	27.55	17,938	2.97	8.03	2,047	1.06
Medicine	25.45	75,551	5.60	13.11	81,020	2.35
Pharmacy	24.73	25,492	3.99	9.96	15,137	1.46
Law	20.60	45,789	4.74	12.74	49,417	2.37
Library Science	14.08	11,364	2.25	8.52	5,183	1.22
Commerce	14.04	11,855	2.31	7.75	1,833	1.07
Forestry	14.00	11,829	2.28	6.71	-3,966	0.88
Architecture	13.65	16,769	2.24	8.03	2,047	1.06
Engineering	13.59	11,307	2.20	6.56	-4,732	0.86
Journalism	11.52	7,625	1.83	7.71	1,449	1.07
Physical Occ. Therapy	0.74	-5,717	0.12	*	-17,711	0.08
Nursing	*	-13,157	-0.37	*	-58,215	-2.62
Theology	*	-39,055	-5.23	*	-38,986	-0.14

TABLE 6.B

SRG's ESTIMATES OF SOCIAL AND PRIVATE  
RETURNS BY PROGRAMME, FEMALES, ONTARIO

1968-69<sup>1</sup>

PROGRAMME	PRIVATE			SOCIETAL		
	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO
Social Work	161.99	74,421	12.29	47.63	81,430	5.97
Vet. Medicine	87.24	82,318	9.93	18.55	69,906	2.54
Dentistry	85.46	132,793	10.94	26.17	144,062	3.71
Physical Occ Therapy	56.32	13,468	8.06	16.54	12,908	2.96
Agriculture	49.32	46,585	6.13	15.12	31,213	1.92
Medicine	42.98	104,208	7.34	17.20	105,180	2.75
Forestry	34.37	36,571	4.95	12.44	23,524	1.69
Engineering	30.76	32,476	4.44	11.47	18,701	1.55
Library Science	29.65	30,320	4.33	14.44	23,223	1.98
Architecture	24.76	37,036	3.74	10.87	21,295	1.48
Pharmacy	23.80	22,048	3.58	8.13	2,444	1.07
Law	16.08	19,006	2.55	7.69	1,107	1.03
Theology	15.74	5,321	1.85	3.75	-4,339	0.73
Nursing	11.47	4,396	1.46	1.78	-18,294	0.47
Journalism	11.60	4,347	1.48	4.38	-7,179	0.68
Commerce	5.00	-3,195	0.65	1.19	-20,554	0.27

- Assuming that 80 per cent of the earnings differential can be attributed to further education. Assuming an overall growth rate of all incomes of 2.7 per cent per annum.
- Using a discount rate of 7 per cent.

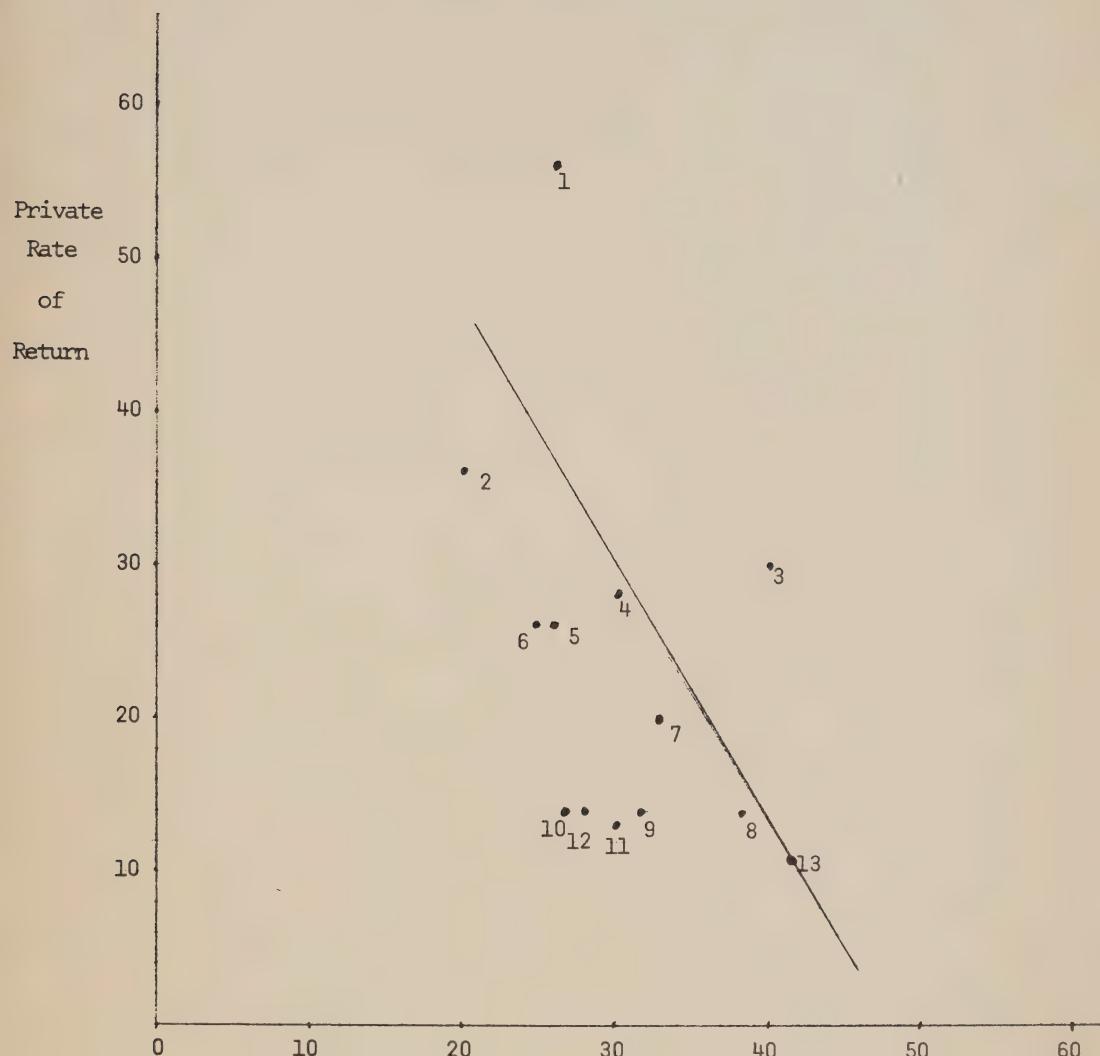
Source: SRG Cost and Benefit Study, pp.101,102.

- (2) There is wide variation among the private rates of return. Dentistry, which tops the list in both the Stager and SRG studies, provides a return of over 50 per cent per annum according to SRG.
- (3) There is a very wide gap between the private and social rates of return in many programmes. The private rate is very significantly higher than the social rate in such expensive programmes as Dentistry, Medicine, Veterinary Medicine, and Law.
- (4) To the extent that the two studies are comparable, their results suggest that over the period from 1961 to 1968-69, the private rate of return to many programmes has increased while the social rate has declined. In any case, it seems clear that the ratio of private rate to public rate has increased sharply, especially for the most remunerative programmes.

The SRG study furnishes data which cast interesting light on the relationship between the public contribution to post-secondary education in Ontario and rates of return to educational investment. Chart 1 indicates the general strong negative correlation between the private rate of return to investment in various university programmes (the same that

CHART 1

RELATIONSHIP BETWEEN PRIVATE RATE  
OF RETURN AND SHARE OF EDUCATION  
COST BORNE PRIVATELY,  
MALES, ONTARIO, 1968-69



Per Cent of Total Cost of Education  
Borne Privately by Student or his Family

SOURCE: SRG Cost-Benefit Study, pp.64, 101

CHART 2

Relationship Between Social  
Rate of Return and Share of  
Education Cost Borne Privately,  
Males, Ontario, 1968-69

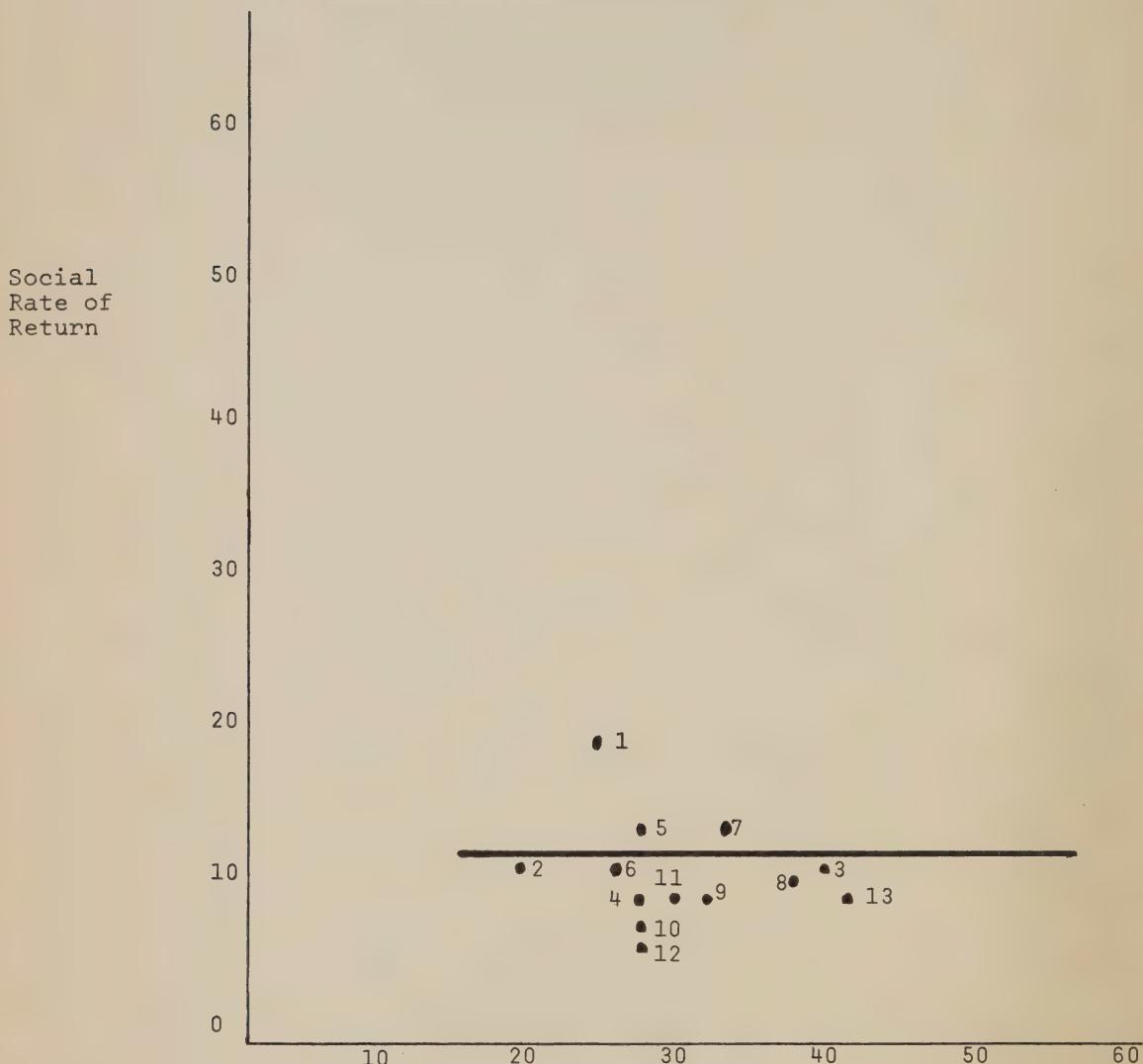
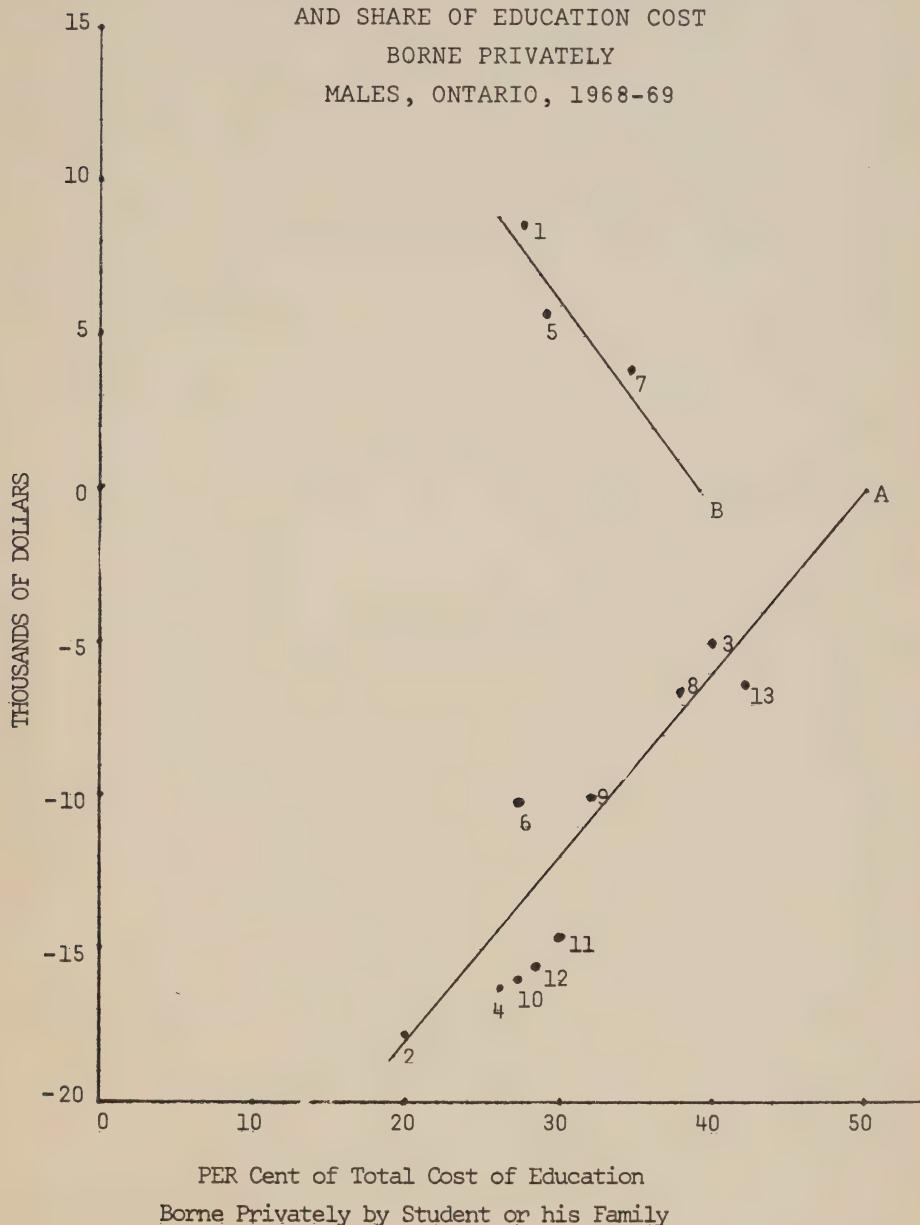


CHART 3

RELATIONSHIP BETWEEN PRESENT VALUE  
OF PURE PUBLIC RETURN (PUBLIC NET PRESENT  
VALUE MINUS PRIVATE NET PRESENT VALUE)  
AND SHARE OF EDUCATION COST  
BORNE PRIVATELY  
MALES, ONTARIO, 1968-69



SOURCE: SRG Cost-Benefit Study, pp.64, 101

are shown on Table 6) and the per cent of the total cost of the education borne privately. In other words, the greater the private rate of return, the smaller the portion of the full cost borne privately by the student or his family.

It might be thought by some people that the extent of public assistance to various educational investment opportunities should be related to the social rate of return. Presumably, the association should be positive if this line of reasoning were followed. Chart 2, however, indicates that there is no discernable correlation between the rate of social return and the degree of sharing of total cost between the public and students or their families.

Another hypothesis seeking to explain the actual or desired relationship between returns and the public contribution might look for a negative correlation between the share borne privately and the difference between the public and the private net present values of the educational investment. The logic here might be that to the extent that the present value of the public return exceeds the private return, the rationale for a public contribution would be strengthened. In Chart 3, however, we see a confusing relationship between these variables. Along the vertical axis in Chart 3 is the "pure public return" computed as follows:

$$\text{Pure Public Return} = \frac{\text{Present Value of Public Return}}{\text{Present Value of Private Return}}$$

For all but three programmes, the "pure public return" is negative; those programmes are Dentistry, Medicine and Law.

In all other programmes, the relationship between the pure public return and the share of total cost borne privately is positive. This means that the more the private net present value of the educational investment in a programme exceeds the public net present value, the greater the share of the public contribution.

These relationships between the returns to educational investment and the sharing of the cost between private and public sources are not necessarily to be considered perverse. But they do raise questions about the real rationale for the magnitude of and the variations among the public contributions to various post-secondary programmes. Why is there a large public subsidy to post-secondary education in Ontario? What is it attempting to achieve? Why are there large differences in the public/private cost-sharing arrangements among the various programmes of study?

#### 1.3.3. Problems and Criticisms of Returns to Education Studies

There are a variety of problems associated with the empirical estimation of the returns to educational investment. Many of these difficulties have been confronted more or less adequately by the investigators in the field. Still, this kind

of work has had ample criticism from professional economists and others. Here we want to take notice of the most serious of these problems and criticisms and to indicate how much they may invalidate the empirical results presented earlier. These various problems and criticisms are organised in the form of answers to a series of polemical questions.

How much are earning differentials really due to educational differences?

Obviously, the observed earning differentials are related to numerous things; to ability, to family position, to inherited wealth, to motivation -- and to education. Several critics have pointed out that there may be strong and positive correlation among these and other income-determining factors.<sup>33</sup>

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<sup>33</sup> John Vaizey, for example, writes: "This leads to a point of major importance; there is a multiple correlation between parental wealth, parental income, access to educational opportunity, motivation in education, access to the best jobs and 'success' in later life. Above all, there is sheer wit and ability which will 'out' despite all educational handicaps. It is dreadfully easy to involve oneself in a chicken-and-egg controversy; 'which came first, the income or the education?' -- especially in old and class-ridden societies. It follows, then, that all the statistics may go to show is that incomes are unequal, and that education is unequally distributed; there may be no necessary causal relationship between education and income." John Vaizey, The Economics of Education, Faber and Faber, London, 1962, p.45.

It must be conceded that there is substantial truth in the existence of multiple correlation among income-causing variables. But we are not without evidence on the separate contribution of each one of these. John Morgan of the University of Michigan and his associates have conducted a comprehensive analysis of the sources of wealth in the United States.<sup>34</sup> Their national sample of heads of households recorded data pertaining to level of personal income, age, formal education, on-the-job training, sex, race, native intelligence, need-for-achievement motivation, parents' education, family size, father's occupation, religion, geographic region, city size, occupational choice, occupational mobility, mortality, unemployment, and hours of work. Multi-variate analysis on this extensive data base indicated that education was the most powerful single determinant of family income. Factors other than education explained only 40 per cent of the earning differentials between college graduates and high school graduates in the age group 18-34 and only 12 per cent in the age group 35-74. Morgan and David conclude that "objections to the use of simple average earnings of different age and education groups on the grounds of spurious correlation are correct but quantitatively not terribly important."<sup>35</sup>

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<sup>34</sup> J.N.Morgan, M.H.David, W.J.Cohen and H.F.Brazer, Income Welfare in the United States, New York, 1962.

<sup>35</sup> J.N.Morgan and M.H.David, "Education and Income," Quarterly Journal of Economics, August 1963, pp.436-437.

Becker in his Human Capital examined five independent American studies of the influence of various factors on earnings. He concluded his examination with the following words:

Five independent adjustments for differential ability -- adjustments that cover such diverse influences as rank in class, I.Q., father's education and occupation, personality, ability to communicate, motivation, and family upbringing -- all suggest that college education itself explains most of the unadjusted earnings differential between college and high school graduates. Although any one study is subject to many qualifications, the evidence provided by all taken together has to be given considerable weight. Consequently, it may be concluded that, even after adjustment for differential ability, the private rate of return to a typical white male college graduate would be considerable, say, certainly more than 10 per cent.<sup>36</sup>

A simple model will help show what we are up against when we try to disentangle the separate contributions of such things as earnings and ability. Consider the relationship shown in equation (6)

$$(6) \quad Y = \beta_0 + \beta_1 E + \beta_2 A$$

where

Y is money income measured in dollars

E is education measured in years of schooling

A is ability measured in standard units

$\beta_0, \beta_1$  and  $\beta_2$  are coefficients

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<sup>36</sup> G.S. Becker, Human Capital, p. 26.

Now if (6) is the "true" relationship, the effect of education on income is given by (7)

$$(7) \quad \frac{\delta Y}{\delta E} = \beta_1$$

Note that  $\beta_1$  is a constant and that  $\frac{\delta Y}{\delta E}$  is not dependent on A. In this case, cross sectional data on Y, E and A would permit an unbiased estimate of  $\beta_1$ .

But what if the "true" relationship is somewhat more complicated with interaction between A and E. Suppose the "true" relationship is as given by (8)

$$(8) \quad Y = \beta_1 + \beta_2 E + \beta_3 A + \beta_4 EA$$

Then the impact of changes in education on earnings would be as shown in (9)

$$(9) \quad \frac{\delta Y}{\delta E} = \beta_2 + \beta_4 A.$$

Obviously,  $\frac{\delta Y}{\delta E}$  is dependent on ability and attempts to estimate a mis-specified function such as (6) from cross section data would lead to biased results. There is no easy way out of this problem simply because we do not know the "true" functional form of the relationship. Empirical studies almost inevitably choose simple forms, such as linear or log-linear, because it lightens the burden of statistical estimation. The truth is that we do not really know what the interactive effect may be of those variables.

Several of the studies of returns to educational investment have adjusted the income differentials downwards to compensate for the contribution of ability and other contributory variables. Denison reduced the observed differentials by about one-third. The SRG study experimented with reductions of 20 and 40 per cent of the earning differentials.

Do earnings measure productivity?

Implicit and sometimes explicit in the returns to educational investment literature is the assumption that wages or other kinds of earnings are a valid and accurate measure of the contribution of their recipients to society. This does not matter very much if we are talking about private returns to education, but it matters a great deal if we are taking the societal point of view. What can be said on this point?

The labour market in Canada is far from perfect. Various kinds of rigidities and monopolistic forces impede the flow of labour services. Suffice it to mention the restrictive practices of the professional medical and dental societies with respect to the admission to professional schools and practice. Vaizey says: "...there is no necessary validity of income distribution at present as a system of returns to effort, talent, merit, or skill; the wage system is, in fact, a system of administered prices, not market prices. Therefore, these measurements are measuring the consequences of a process of market

imperfections so serious as to invalidate the results if they are used to estimate returns to education."<sup>37</sup>

There can be little doubt that the returns to education in certain professions are exaggerated because of the market power of professional societies. It is true that one cannot become a dentist without a dentist's education, but to ascribe to dental education the enormous rate of return that we observe is patent nonsense. It is, in fact, a rental return to monopoly power. The indicated social action, if we wish to maximise social product, is first to break the artificial barriers to entry into this profession and then to educate more dentists. The same is naturally true of medical doctors. Beyond these two professions, it seems still doubtful that the grip of professional guilds is yet strong enough to invalidate the presumption that earnings roughly measure the marginal contribution of individuals to society. To say this is not to be sanguine about how long this may continue to be true. The proclivity of every group with the most embryonic measure of self-consciousness to declare itself a "profession" and to gird itself to exert market power on behalf of higher wages and other boons is depressingly ubiquitous. We may indeed be at the dawn of neo-mercantilism.

How about the external benefits of education?

Every critic, be he foe or friend of public aid to higher education, of the measurement of the returns to

educational investment, levels the charge that there are significant payoffs to education that are not captured by the monetary returns to the individuals receiving the education. What do we say about this?

The external benefits of higher education exist and they may be very large. Think for a minute about the contributions made to the welfare of mankind of individual pieces of learning; the discovery of insulin by Banting and Best, the contribution to the art of macro-economics control by Keynes and his followers, the conquest of polio by Salk and Sabin. Those three things alone have contributed as much to mankind as has been spent on higher education since the beginning of time. If you doubt this, think what we would be prepared to pay today to avoid the re-imposition of the scourges of diabetes, massive economic depression and infantile paralysis.

All that can be said for the present is that knowledge is, to a large extent, a public good in that restriction on its use is difficult or impossible to effect once it has been created. There is no reason, therefore, to expect that the returns to those creating knowledge will correspond to the total value of this knowledge to society. There are, in other words, external effects of knowledge creation. To the extent that education increases the ability of a society to create and apply knowledge, the measurable returns to that

education are understated.

But aren't there consumption benefits of post-secondary education?

Some people undoubtedly derive satisfaction from obtaining education; others may derive misery. There are also boons and malefactions associated with the educational experience; some people find mates and that presumably is a boon. Others may find an inferiority complex and few would welcome this. For the longer pull, learning may furnish some with a continuing source of satisfaction derived from greater sensitivity; others may develop expectations that turn out to be unrealistic or unjustified.

In any case, there are various kinds of direct consumption benefits and costs as well as (mainly) benefits of the nature of a durable consumer good. These are not taken into account by the measurement of pecuniary returns to investment in education but it is hard to believe that, if they were measured, they would diminish the estimated rates of return.

1.3.4. Overall Evaluation of the Measurement of Returns to Education

There are surely problems that compel caution in the use of our measures of the returns to investment in post-secondary education. Nevertheless, all of the studies that have

been done indicate high private rates of return to such investment. The kinds of doubts occasioned by the conceptual and data difficulties of this measurement appear to reinforce the proposition that the private returns are, indeed, high. It must be confessed, however, that recent studies cast doubt on the munificence of the social rate of returns to many kinds of higher education. It seems that the significance of these findings for public policy is inescapable. Basically, the meaning of the estimates of modest social rates of return is that the justification of continued high public subsidy must be found in the external benefits of those subsidies rather than in the direct return. Public decision-makers and educators should think about where these external returns may lie.

#### 1.4. The Distributional Effects of Public Expenditures in Post-Secondary Education

Who pays? Who gains? These questions are the twin foci of interest when studying the distributional effects of public expenditures in post-secondary education.

Every programme of public expenditure involves costs and benefits that are borne unequally by individuals and groups in society. The resources that are diverted to post-secondary education by the expenditure of public funds cannot be employed to produce the alternative goods and services foregone by that diversion. Those resources diverted into post-secondary education

cannot be used in private consumption or investment nor can they be employed in alternative government programmes such as transportation, health or housing. Those who might have benefitted from these alternative private and public uses of resources, therefore, have sustained a kind of opportunity cost as a result of the public expenditure on post-secondary education.

The benefits of public expenditures on post-secondary education can also differ greatly in their impact on various individuals and groups in society. Obviously, the direct recipients of the education receive a variety of benefits of consumption and investment natures. Those associated with the "delivery" of educational services may be thought of as receiving benefits. The members of various academic professional groups, for example, may find that the demand for their services increases, relative to those of other professional groups, as a result of increased public expenditure on post-secondary education. Similarly, private organisations associated with the design and construction of educational facilities may experience greater revenue and profit as a result of capital expenditure programmes of post-secondary educational institutions. Property owners and other interest groups located near educational institutions may find the worth of their assets increased or decreased as a result of the expansion or contraction of public post-secondary educational expenditures.

There can be little doubt that public decisions concerning the various expenditure programmes have important distributional consequences. Whether they are explicitly stated or hidden, distributional objectives seem to be paramount in the minds of elected officials and policy-makers who are responsible for the magnitude and incidence of public taxation and expenditure. It is surprising, therefore, that the analysis of distributional impacts of public expenditure programmes only recently has begun to occupy the attention of economists.

Most public programmes are administered with little attention to their distributional impacts. People are frequently surprised, after the fact, when these programmes exhibit perverse distributional consequences. It is unfortunately true that the information necessary to trace these distributional impacts of public expenditure programmes is infrequently collected. Without that information, we permit our public programmes to work at cross purposes, we waste resources, and we fail to attain programme objectives.<sup>37</sup>

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J.T.Bonnen, "The Absence of Knowledge of Distributional Impacts: An Obstacle to Effective Public Analysis and Decisions", in R.H.Haveman and J.Margolis (eds.), Public Expenditures and Policy Analysis, Markham, Chicago, 1970, p.246.

1.4.1. The Information Necessary to Assess Distributional Impacts of Public Expenditures on Post-Secondary Education

What information is needed if we are to assess the distributional impact of public expenditures in post-secondary education and to judge their desirability? Ideally, we should be able to answer the following questions in about the same order as they are posed below.

For Benefits:

1. What is the purpose or objective of the public expenditure on various post-secondary educational programmes and, as part of this question, who should benefit?
2. Who actually benefits, which groups? We shall see later that one may define beneficiary groups in a variety of ways.
3. How much are the total benefits of the various expenditure programmes? From our earlier discussion of educational benefits, we know that this is not a simple question.
4. What is the distribution of programme benefits among the various beneficiaries?
5. What are the values of relevant indicators of status and welfare (e.g., current income, wealth, age, sex) among the actual beneficiaries and the intended or potential beneficiaries?

For Costs:

6. Who should pay the programme costs? This question is infrequently addressed explicitly at the policy level and, even when it is, poses a thorny problem concerning the relevant opportunity costs to be included.

7. Who actually does pay the cost of the programme? The empirical identification of cost incidence plunges one into the tax structure, price and income effects, government budgetary priorities and the indirect effects of resource and product substitution caused by the programme.
8. What are the total programme costs? The answer to this question should be based not only on institutional and governmental expenditures but on the various opportunity costs generated through the operation of the programme. Obviously, such analysis is not simple.
9. How are programme costs distributed among the burdened groups?
10. What are the values of relevant indicators of status and welfare among the actual burdened groups and the intended or potential burdened groups?

Finally, and very importantly, for policy concerning public expenditures on post-secondary education:

11. Integrating the information provided by the answers to the previous questions, what are the alternative ways of achieving the same public objectives and how well does public investment in post-secondary education compare in terms of distributional and other impacts with those alternatives? For policy purposes, we need to know when public subsidies to higher education can and cannot achieve desired social objectives, including the distributional ones, more efficiently and with less undesirable spillover than other instruments of public policy.<sup>38</sup>

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Ibid., pp.247 and 248. See also, J.T.Bonnen, "The Distributional Benefits from Cotton Price Supports", and Burton A.Weisbrod, "Income Redistribution Effects and Benefit-Cost Analysis", in Samuel B.Chase Jr. (ed.), Problems in Public Expenditure Analysis, Brookings, Washington, D.C., 1968. See also R.A.Musgrave et.al., "Distribution of Tax Payments by Income Groups: A Case Study for 1948", National Tax Journal, March, 1951,pp.1-53.

#### 1.4.2. Which Groups?

Both the costs and benefits of public expenditures in post-secondary education come to rest on individuals in society. It is obviously true that there is an infinity of ways of aggregating those individuals into groups for analysis. They can be categorised by levels of current income, expected or lifetime income, wealth, place of residence or other geographical descriptors, nationality or ethnic characteristics, age, sex, marital status, occupational category, parental education or occupation, etc. All of these and other criteria have been used to classify individuals into policy-relevant groupings.

It is obviously true that the relevance of grouping individuals into particular categories depends upon the policy questions that are being asked. Most of the empirical studies of the distributional impacts of public expenditures on post-secondary education have grouped individuals according to the income levels of their parents.<sup>39</sup>

This aggregation according to family income was

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See R.W.Judy, "The Income Redistributive Effects of Aid to Higher Education", in L.H.Officer and L.B.Smith (eds.), Canadian Economic Problems and Policies, McGraw Hill, Toronto, 1970, pp.302-317; W.L.Hansen and B.A.Weisbrod, Benefits, Costs and Finance of Public Higher Education, Markham, Chicago, 1969, 114Pp.; J.Pechman, "The Distributional Effects of Public Higher Education in California", Journal of Human Resources, Summer, 1970,pp.361-370; Systems Research Group, Cost and Benefit Study of Post-Secondary Education in the Province of Ontario, Commission on Post-Secondary Education in Ontario, 1971, esp. Section 4.5, pp.79-92.

chosen because the investigators believed intra-generational social mobility to be an important objective of public expenditure programmes in post-secondary education. Clearly, this has not been the only redistributional objective and much more work remains to be done.

#### 1.4.3. Which Costs?

The costs of public expenditures on post-secondary education can be traced in many directions. To know which direction and which impact should be evaluated demands penetrating analysis.

Let us begin with a discussion of the incidence of taxation. The various governments contributing financial support to post-secondary education derive their revenue from a variety of tax sources. The individual income tax, corporate tax, sales tax, and various other taxes yield revenues. Tracking down the direct and shifted incidence of these various taxes is an exacting and arduous task.<sup>40</sup>

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The best publicly available study of this kind in Canada is W.I.Gillespie, The Incidence of Taxes and Public Expenditures in the Canadian Economy, Studies of the Royal Commission on Taxation, Number 2, Queen's Printer, Ottawa, 1964, 273 Pp. A more recent analysis, unreleased as of the date of this writing, has been prepared by the Economic Council of Canada.

Even so, knowledge of the incidence of all taxes is not sufficient to determine the distributional effects of public expenditures on post-secondary education. It is necessary to know which specific taxes and which specific expenditures on other government programmes would be altered in order to accommodate a given expansion or contraction of public expenditures on post-secondary educational programmes.

In essence, what is being attempted is a hypothetical experiment whose nature can probably best be illustrated by an example. Suppose we observe a certain pattern of expenditures on post-secondary education and that we know the incidence of all kinds of taxes. Suppose further that we contemplate an expansion of x million dollars in expenditures on post-secondary education in the Province. We wish to compare the distribution of taxes paid and non-educational benefits enjoyed by relevant groups of the population under two different alternative states of the world: (1) the one in which the additional educational expenditure is made and (2) that in which it is not made. Unfortunately for the purpose of easy analysis, there is an infinity of possible ways of not devoting the resources to the given expansion of post-secondary educational expenditures. Therefore, there is no unique alternative state of the world with which to compare the one in which the expansion takes place.

To illustrate further, the additional funds could be raised solely by increasing the yield of the sales tax or any other particular tax or mix of taxes. Each variant would have specific distributional consequences. Alternatively, all taxes could be left unchanged and the level of expenditure in some other public programme, say hospital construction, could be curtailed with funds being diverted to the post secondary education sector. Obviously, the burden associated with this alternative would be different from that of an increased corporate tax. To repeat, there is an infinity of possible ways of not spending the resources on post-secondary education. There is, therefore, a corresponding infinity of social opportunity costs and distributional impacts. In order to make any sense of the matter at all, it is necessary to be specific in saying how and from which combination of alternative public and private uses the increased resources to be expended on post-secondary education would be sprung loose.

#### 1.4.4. Which Benefits?

There are a number of possible ways of defining benefits. The most direct is to say simply that the benefit going to an individual who is receiving a public educational subsidy is the amount of that subsidy, i.e., the algebraic difference between the average cost of providing a particular

kind of educational service and the amount that an individual must pay in order to avail himself of that service.<sup>41</sup> Depending on the focus of policy or analytical interest, it may be desirable to examine "external" benefits of post-secondary education, the benefits accruing to specific groups such as academics or construction firms, and even to consider multiplier effects when full employment cannot safely be assumed to exist.<sup>42</sup>

It should be clear that the study of distributional impacts must always be an exercise in relativity analysis. One particular "state of the world" is being compared with another hypothetical state of the world and the problem is to be very

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<sup>41</sup> This was the definition used by Judy, Hansen, Weisbrod, Pechman and Systems Research Group in the studies cited earlier.

<sup>42</sup> The design of an interesting and useful type of distributional analysis is laid out in J.Caffrey and H.H.Isaacs, Estimating the Impact of a College or University on the Local Economy, American Council on Education, Washington, D.C., 1971. The purpose of the approach outlined by Caffrey and Isaacs is to assess, in detail, the "neighbourhood" effects of a specific educational institution on its immediate surroundings. The Caffrey/Isaacs methodology has been expanded and applied in an exhaustive study of the local impact of the University of Pittsburgh, a study prepared by the Systems Research Group Inc. A large number of immediate economic impacts were examined including the income and employment effects of University expenditures, alterations in local property values attributable to the University, the imposed load on various public services, such as fire and police protection, and the contribution of human capital to the Pittsburgh area. See, J.Caffrey and G.Mowbray, The Impact of the University of Pittsburgh on the Local Economy, Educational Systems Research Group, Washington, D.C., 1971 (forthcoming).

specific about which alternative hypothetical state is taken as the standard of comparison. It is hard to think of a subject more necessary and useful for policy analysis than is, at the same time, so fraught with potential for misinterpretation.

#### 1.4.5. Some Empirical Results

The earliest investigation of the redistributive effects of public expenditures on post-secondary education in Canada came to the following cautious conclusions:

The hypothesis that the overall income-redistributive effect of public aid to higher education is regressive is not supported by the findings reported here. This is true whether the recipients of the benefits are taken to be the students themselves (in their capacity as earners of future income) or their parental families. The slight overall redistributive effect measured is in the progressive direction. In view of the approximations of data and analysis, however, it is not to be accorded much significance.<sup>43</sup>

Subsequent and much more intensive analysis of the situation in Ontario came to different and stronger conclusions. Here it was concluded that:

In light of the available information, it can be concluded that expenditure on post-secondary education is regressive, though not extremely regressive.<sup>44</sup>

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<sup>43</sup> R.W.Judy, "The Income Redistributive Effects of Aid to Higher Education", op.cit., p.314.

<sup>44</sup> Systems Research Group, Cost and Benefit Study of Post-Secondary Education in the Province of Ontario, op.cit., p.81.

SRG found that some 33.9% of the benefits were received by students whose families had incomes in excess of \$10,000 per annum while about 28.2% of all post-secondary educational costs fell upon families with incomes of \$10,000 or more.

Some of the most interesting results of the SRG study of distributional effects are displayed in Table 7. So far as universities are concerned, the system of public financing of universities in 1968-69 appears definitely to be regressive. On the one hand, taxpayers with family income groups under \$7,000 contributed an estimated 53.74% of the public subsidy to post-secondary education while students whose families had an annual income under \$7,000 received only an estimated 39.96% of the benefits. On the other hand, taxpayers with a family income of \$7,000 or more contributed some 46.25% of the subsidy but students from families reporting taxable income of \$7,000 or more received over 60% of the benefits of the subsidy.

The regressive effect was even more pronounced in certain expensive university programmes; for example, 64.32% of the benefits of undergraduate Medical education were estimated to have gone to students whose families reported \$7,000 or more taxable income. For Law, where the situation was even worse, 71.58% of the benefits were calculated to have gone to the over \$7,000 group. Among the other university programmes, Pharmacy and Engineering appear to have had a less regressive distributional impact.

TABLE 7

Redistributive Impact of Public Expenditures on  
Two Sectors of Post-Secondary Education in Ontario, 1968-69.  
(Percent of subsidy and benefit)

		Family Income Groups				
		Under \$3,000	\$3,000-\$4,999	\$5,000-\$6,999	\$7,000-\$9,999	\$10,000+
<b>1. Universities.</b>						
<b>Subsidies</b>						
Federal	7.68	18.32	25.58	21.82	26.60	
Province of Ontario	10.39	20.00	25.53	20.60	23.48	
Average Senior governmental (a)	9.03	19.16	25.55	21.21	25.04	
<b>Benefits</b>						
All university programmes	9.36	12.35	18.25	24.41	35.63	
Pre-Medicine & Medicine	9.02	11.02	15.61	23.95	40.37	
Law	6.17	6.67	15.54	22.17	49.41	
Dentistry	10.10	10.31	19.96	26.10	33.51	
Arts, lower two years	8.57	11.24	18.45	25.01	36.71	
Pharmacy	10.07	17.19	23.96	29.38	19.37	
Engineering	11.48	14.96	19.53	24.56	29.44	
<b>2. Colleges of applied arts &amp; technology.</b>						
<b>Subsidies</b>						
Federal	7.38	18.45	26.39	22.47	25.33	
Province of Ontario	10.40	20.01	25.52	20.59	23.47	
Average senior governmental (a)	8.89	19.23	25.95	21.53	24.35	
<b>Benefits</b>						
All CAAT programmes	7.48	11.04	31.77	27.13	22.58	

(a) Unweighted average of federal and Ontario percentages.

Source: Systems Research Group, Cost and Benefit Study of Post Secondary Education in the Province of Ontario, School Year 1968-69, Volume 1, April 1971, pp. 82, 84, 85 and 89.

Notes to Table 7

1. Interpretation

Table 7 indicates the percentage of governmental subsidies to universities and colleges of applied arts and technology contributed by taxpayers belonging to five family income groups. Thus, 7.68% of the federal subsidy is computed to have come from families whose annual family income in 1968-69 was under \$3,000. Some 26.6% of the federal subsidy came from families with income exceeding \$10,000.

The benefits are the percentage of the governmental subsidies redounding to students whose parents belong to the same five income categories. Thus, for all university programmes, 9.36% of the total governmental subsidy accrued to students whose families had incomes of under \$3,000, 12.35% went to students whose families had income in the range \$3,000 - \$4,999, etc.

2. The Methodology

The methodology employed in arriving at these percentages is described in detail in Volume 2, Cost and Benefit Study of Post-Secondary Education in the Province of Ontario.

At least for the year 1968-69, the picture with respect to the colleges of applied arts and technology (CAATs) appears rather different from that of the universities. Students whose family incomes fell between \$5,000 and \$10,000 per annum were the chief beneficiaries of the CAATs subsidy. Taxpayer families under \$5,000 and over \$10,000 contributed proportionately more than was received by students whose family incomes fell into those categories.

If one looks only at the least affluent groups in Ontario society, those with a family income under \$5,000 per annum, expenditures on both universities and CAATs appear regressive. On balance, the universities are most beneficial to students whose family incomes exceed \$7,000 per annum while the CAATs appear to benefit a large middle class of students whose families reported between \$5,000 and \$10,000 per annum.

Studies of California data by Pechman, Hansen and Weisbrod produce results that are consistent with those of Ontario obtained by SRG. Tables 8 and 9 display those results. Concluding their study of the benefits, costs and finances of public higher education, Hansen and Weisbrod state:

Public subsidies for higher education in California tend to go disproportionately

..... continued

TABLE 8

Size of Public Higher-Education Subsidies  
and Average Parental Income, by Type of College Attended

Type of College Attended (1)	Average Public Higher- Education Subsidy per Student (2)	Average Parental Income (3)
No College	\$0	\$7,900
Junior College	720	8,800
State College	1,400	10,000
University	1,700	12,000

Source: W.Lee Hansen and Burton A.Weisbrod, "The Distribution of Costs and Direct Benefits of Public Higher Education: The Case of California," Journal of Human Resources 4 (Spring, 1969)

TABLE 9

Relationship between Average Annual Public Higher-Education Subsidies and Parental Income, by Level of Parental Income

Level of Parental Income (1)	Average Public Higher Education Subsidies (2)
\$ 0 - 3,999	\$ 56
4,000 - 5,999	122
6,000 - 7,999	129
8,000 - 9,999	126
10,000 -11,999	179
12,000-13,999	167
14,000-19,999	229
20,000-24,999	271
25,000 and over	291

Source: Joseph A.Pechman, "The Distributional Effects of Public Higher Education in California," Journal of Human Resources 5 (Summer, 1970)

to students from relatively high income families and are received in quite different amounts by students even within given income classes. Almost 40% of the student age population receives no subsidy whatsoever, while a relatively small group receives very substantial subsidies. Whether this pattern of subsidy distribution is consistent with the social objective of equality of educational opportunity is certainly open to question.<sup>45</sup>

1.4.6. Conclusions about the Redistributive Effects of Public Expenditures on Post-Secondary Education.

It has been argued that the distributional consequences of public decisions concerning expenditure on post-secondary education have major and increasingly important impacts on Ontario society. There are good reasons to believe that "equity" objectives relating to equality of opportunity and social mobility motivate the very large public expenditures on post-secondary education in this Province. Despite these things, we have only begun to study the processes by which distributional impacts are institutionalised and filtered through the society. We have given little thought to how to re-design our taxation and expenditure systems, in the field of post-secondary education and elsewhere, to achieve our social objectives. We have only preliminary assessments of the distributional impacts of our post-secondary education and other public expenditure programmes. What little we do know suggests

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<sup>45</sup> W.L.Hansen and B.A.Weisbrod, Benefit Costs and Finance of Public Higher Education, Markham, Chicago, 1969, p.84.

that there are many surprising and apparently perverse distributional impacts. Past decisions made without sufficiently clear social objectives and without adequate distributional knowledge often appear in retrospect, given what seem to be our present objectives, to lack in economic and social wisdom. It seems appropriate to close this section with a quote from J.T.Bonnen's thoughtful article:

Both the integrity of our many public commitments in equity and our efficiency in the use of tax monies to attain public ends require far greater effort to collect data for programme analysis of the distributional impacts of public decisions.<sup>46</sup>

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J.T.Bonnen, "The Absence of Knowledge of Distributional Impacts; An Obstacle to Effective Policy Analysis and Decisions," op.cit., p.268.



## II. Unit Cost Analysis

The literature on unit cost analysis of educational activities is large but not particularly illuminating.<sup>47</sup> Lack of conceptual development and data difficulties have impeded progress in the theory and empirics of educational costing. Dr. Pierre Paul-Proulx has recently surveyed six major Canadian efforts in this field. His results are contained in a paper soon to be published by the Economic Council of Canada.<sup>48</sup> A review of cost studies in the U.K. authored

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The following books and articles constitute a fair sampling of the literature:

A.J.Carroll, Medical College Costs and Manual of Procedures, Association of American Medical Colleges, Evanston, 1965.

Salvatore Corrallo, An Analysis of Instructional Expenditures For Institutions of Higher Education in the Northeast United States for Years 1961-62 and 1963-1964, and 1965-1966, U.S.Government Printing Office, Washington, 1968.

John M.Evans and John W.Hicks, An Approach to Higher Educational Cost Analysis, Studies in Higher Education, Purdue University, Division of Educational Reference, Lafayette, Ind.

James L.Miller, State Budgeting for Higher Education: The Use of Formulas and Cost Analysis, University of Michigan Institute of Public Administration, Governmental Studies #45, Ann Arbor, 1964.

<sup>48</sup>

Pierre Paul-Proulx, "Cost Studies in Post-Secondary Education," a paper presented at an Economic Council of Canada seminar on "The Political Economy of Canadian Education," Montebello, Quebec, October 1971, 112 Pp. The studies surveyed were the following: (1) The University of Calgary, Office of Institutional Research, A Proposal for a Cost Study, 1969-70, March, 1970; (2) AUCC., An Exploratory Cost Analysis of Some Canadian Universities, Ottawa, 1970; (3) J.B.MacDonald et.al., The Federal Government and Research Grants in Canadian Universities, Science Council of Canada, Special Study No.7;

footnote continued.....

by G.Wilson and P.Lewis, has also recently been published.<sup>49</sup>

It is impossible within the scope of this paper to review the specific methodologies and numerical results that have been achieved in these various cost studies. For this, the interested reader must be referred to the original documents and to the surveys that have been cited.

A variety of methodologies have been followed by the students of unit costs in post-secondary education. One of the most common, followed by Carroll in medical schools, Knott in nursing programmes and by the AUCC in their recent study of university costs in Canada, is the so-called "step-down" method. Under this procedure, the expenditures of the "purest" overhead cost centre (e.g., the office of the president) are allocated downward to the cost centres served in proportion to the benefits derived by them. Overhead allocation down the pyramid of cost centres continues until the primary cost centres are reached and all overhead has been allocated to them. Obviously, the rules

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(4) Committee of Presidents of Universities of Ontario, Ring of Iron: A Study of Engineering Education in Ontario, December, 1970, and more particularly, I.W.Thompson and P. A.Lapp, A Method for Developing Unit Costs in Educational Programs, CPUO Report No.70-3, December, 1970; (5) M.D. Segal, The Political Economy of Resource Distribution in Quebec Universities, The Conference of Rectors and Principals of Quebec Universities, November, 1970; (6) Systems Research Group, Cost and Benefit Study of Post-Secondary Education in the Province of Ontario, School Year 1968-69, April, 1971.

49 G.Wilson and P.Lewis, Cost Studies in Higher Education, Higher Education Research Unit, London School of Economics and Political Science, Reprint No.34. Also published in Higher Education Review, Vol.2, No.2, Spring 1970.

for overhead allocation are to some extent arbitrary although rationale is sought for them in measurements of workloads and services rendered to "consumer" cost centres. The "primary cost centres" usually turn out to be academic departments and the direct and overhead costs of these are distributed among academic activities usually on the basis of faculty time or effort distributions.<sup>50</sup>

There are serious difficulties in collecting accurate and meaningful data on the distribution of academic staff time and/or effort. Philip Lapp and Ivor Thompson, in their study of the costs of Ontario engineering education, used a measure of staff contact hours to allocate departmental costs among various academic programmes. A "staff contact hour matrix" was developed for each university. Each vertical column corresponded to a department and displayed the staff contact hours for each programme within the engineering faculty and a summary "programme" for students from other faculties. A vector of cost-per-staff-contact hour was developed for each faculty of engineering and programme costing reduced itself to rather simple matrix algebra. Subsequently, the "unit" costs per student were plotted against number of students and a curve was fitted to produce an estimate of the "cost function" of producing engineers.

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For an exposition of this methodology, see Leslie W. Knott and others, Cost Analysis for Collegiate Programs in Nursing: Part 1, Analysis of Expenditures, National League for Nursing, 1956.

Of the two methodologies used in the AUCC and the Lapp-Thompson studies, the one employed by the latter is substantially superior. In a larger sense, however, it is not possible to decide which methodology is preferable without specifying the uses to which the cost information is to be put. Why, indeed, do we wish to know about the costs of post-secondary education?

Some interest may be motivated by a concern with fiduciary control; another interest may be for ex post comparison of similar programmes in different institutions. Still another would be for the purpose of dividing the total cost among various funding sources on the basis of some set of percentages. But one of the most important uses to be made of cost information is in guiding decisions about the allocation of resources.

Resource allocation decisions include responses to questions such as: What would an x% expansion of programme y at institution a cost annually for the next five years? How does this cost compare to a similar expansion at institutions b, c and d? In order to accommodate an n% increase in enrolment in a system of colleges, does it make more economic sense to create a new institution or to expand existing ones? If the latter, in what proportion should they grow? How much could be saved if programme w were to be eliminated at institution g and

expanded at one or more other institutions?

For these and most other allocative questions, the relevant information relates to marginal or incremental costs. Average or "unit" costs are reasonable proxies to marginal costs only under rather special circumstances. One such circumstance is under conditions of constant costs, a situation unlikely to prevail in educational institutions with substantial investments in fixed plant and equipment. Another such circumstance would be if certain assumptions commonly made in the micro-economic theory of the firm were justified; these assumptions posit profit-maximising behaviour and competitive equilibrium in the market - the equality of price, marginal cost and average unit cost can be shown to be equal within the model. The non-economist should not try to decipher the economics jargon of the preceding sentence; the assumptions required for competitive equilibrium are certainly not satisfied in the present conditions of the post-secondary "market". The conclusion is that average costs are very unreliable proxies to marginal costs.

A second major problem bedevilling attempts to determine the costs of teaching, research and other activities in post-secondary educational institutions is the one that economists call "joint production". Many activities in universities and colleges simultaneously contribute to the achievement of

several different objectives. For example, a small group clinic in a medical school involving a member of the academic medical staff, a resident and some medical students may simultaneously promote the delivery of health care to a patient, the education of junior members of the health team and research on a particular aspect of medical science. Or a professor of physics, preparing his lecture for an advanced course in high energy physics, may be furthering a research objective at the same time he is organising his thoughts for instructional purposes.

When it comes to the problem of allocating historically incurred costs among various supposedly mutually exclusive programmes, all of the "unit costs" studies are inadequate. Attempts have often been made to use information describing the distribution of academic staff time and/or effort among various major programme categories. Such attempts fly in the face of known jointness of production and are strictly arbitrary ways to attribute total costs to separate programmes connected with instruction, research and other objectives. A farmer who attempted to attribute the total cost of raising a sheep separately to the production of wool and the production of mutton would be attempting a comparably impossible task.

A third shortcoming of most of the "unit cost" studies is that they have been oblivious to the concept of opportunity costs. As Pierre Paul-Proulx put it in the following words:

With the exception of the SRG study, and to some extent, but in a more restricted way the Segal study, most of the cost studies examined ... paid no more than lip service to the need to introduce opportunity costs into cost analysis, if at all. This is presumably because of the internal purpose and the budgeting concern which has been prevalent, but with the development of planning programme systems, the emphasis, it would seem to me, will go towards the explicit recognition and computation of costs in what is known to be the opportunity cost category.... The SRG study is a very interesting demonstration of the fact that the costs and benefits of post-secondary education, as determined by accounting costs, are very different from those determined by taking into account opportunity costs.<sup>51</sup>

A final serious shortcoming of "unit cost" studies is that they are static. They are done for a particular year, entombed within the binders of a report and are unsuited for further analysis. For most managerial decision-making, either at the level of the individual institution or at the system level, the need is for an instrument that will allow experimentation. Decision-makers want, or should want, to be able to ask "What if ...?" questions and to get answers. The static cost study permits but little experimental question asking.

To conclude this rather dismal assessment of unit cost studies, it should be repeated that their usefulness depends strictly on the purpose for which they are intended. For policy

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51 Pierre Paul-Proulx, "Cost Studies in Post-Secondary Education", op.cit., pp. 95 and 96.

and managerial purposes, where the decision at hand is whether to expand or contract a particular post-secondary educational activity by a certain amount, the "unit cost" studies are of very limited relevance. It has been argued that marginal, avoidable, opportunity costs are the ones relevant for this purpose. There is no reason to think that static unit cost studies can be of much help here.

A most promising innovation in the area of educational cost analysis has been the recent development and use of cost simulation models. Early work on such models was undertaken at the University of Toronto<sup>52</sup> and at the University of California.<sup>53</sup> Subsequently, it has been continued at the Western Interstate Commission on Higher Education in Boulder, Colorado, and at the Systems Research Group Inc. in Toronto. SRG has installed cost prediction models, called CAMPUS models, in the 20 Ontario colleges of arts and technology and at various universities and colleges in the United States. Models of the CAMPUS type permit educational administrators to study the cost structure of their institution either in historical retrospect or in an ex ante mode appropriate to forward planning.

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52 R.W.Judy and J.B.Levine, A New Tool for Educational Administrators, University of Toronto Press, 1966.

53 G.B.Weathersby, The Development and Applications of a University Cost Simulation Model, University of California, Berkeley, California, 1968.

### III. Applications of Economic Reasoning to Problems of Educational Policy and Planning

Most of the discussion in preceding parts of this paper has been devoted to the empirics of the economics of education. Several attempts to measure costs and benefits of post-secondary education have been discussed. But to judge the contribution of economics to the problems of educational policy and planning by the credibility of specific numerical computations would miss the most significant part of that contribution.

In a fundamental sense, economics is the science of choice, the study of the allocation of limited resources to achieve multiple and conflicting goals. It is the study of how men and institutions are organised and behave in order to make the most of what is possible within the constraints of technique and resource availability. It is a discipline, a way of structuring and thinking about problems, that has much to contribute to public policy and planning. The potential of this contribution remains largely untapped for a variety of reasons and this section is intended to suggest some of the areas where economic reasoning, as opposed to economic empirics, promises significant payoffs.

### 3.1. Micro-Economic Logic

Micro-economics deals with the economic behaviour of individual units such as organisations, human beings, government agencies, etc. A fundamental axiom of micro-economics is that all such decision-making units seek to maximise the achievement of their goals subject to certain constraints. In studying decision-making behaviour, the economist's instinct tells him first to seek out the objectives that the decision-making unit is attempting to maximise and second, to devise measures with which to assess achievement of those objectives.

At the level of public policy, micro-economic reasoning impels the analyst to seek out the social goals and objectives that the public and policy-makers hope to achieve. These objectives may be diverse; economic development, equality of opportunity, cultural and scientific advance, etc. They may even include the desire of politicians to maximise the probability of re-election or the desire of civil servants to build bureaucratic empires. The point is that goals do exist and it is necessary to ferret them out and render them explicit.

Next comes the search for constraints that limit the achievement of objectives. These may take the form of budgetary constraints, the limits of political feasibility, the availability of certain resources and limitations of the "state of the art"

or technology. Constraints always exist and it is important to understand what they are and what may be the value (in terms of fuller achievement of the objectives) of relaxing those constraints.

Another idea of micro-economics is that of a process by which various resources or inputs are transformed into outputs, i.e., goods and services that are valuable in terms of the objectives of the decision-making unit. Production, in its generic meaning, is this process of transforming inputs into outputs. An important notion of the theory of production is that normally there is a substantial degree of substitutability among various inputs in the production of a given set of outputs. This idea of substitutability or "variable proportions" leads the micro-economist to look for "tradeoffs" in production. When a particular input to a production process becomes relatively more scarce or more expensive, economic logic dictates that there should be some substitution of less expensive inputs for it in the production process. Thus, if the cost of services rendered by academic staff rises relative to other inputs into the learning process, e.g., television or other "new media", the appropriate response is to seek ways of substituting the relatively less expensive inputs for the increasingly expensive ones.

The idea of tradeoffs applies also to achievement of objectives. The importance of an incremental gain in achieving

one particular objective usually depends on how much of that objective has already been obtained. Thus, the social contribution of ten additional Ph.D.'s in East Asian studies undoubtedly depends upon how many specialists of this kind are already working in a community. Extending the idea of tradeoffs, the micro-economist always searches for ways in which more abundant inputs may be substituted in a production process without diminishing the value of the goods and services produced. He seeks to learn the incremental or marginal value of expanding the output of various goods and services so as, without increasing the total cost of things, to achieve a relative expansion in the production of those outputs for which the ratio of incremental value to cost is the greatest. This kind of reasoning might lead an analyst to inquire about the real contribution to a physician's competence (and, therefore, to community health care) of the final year of medical specialty education. The major point is that micro-economic reasoning prompts question asking and analysis that can improve the social payoff from our investment in post-secondary education.<sup>54</sup>

### 3.2. Incentive Structures

It is an economic axiom that something is always being maximised. The maximand may be one specific goal or objective

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54 It is impossible here to provide a full exposition of the micro-economics of education; perhaps the best exposition of this is Andre Daniere, Higher Education in the American Economy, Random House, 1964, 206Pp.

or it may be a function of several things. For individuals and organisations these arguments of the objective function may be wealth, prestige, status, power, size of staff or many other things. It is profoundly wrong to think that economics deals only with monetary maximands.

Every organisation has some kind of incentive or reward structure. The way salaries are determined, promotions awarded or status achieved is non-random in all purposeful organisations. These "rules of the game" define the environmental constraints within which individuals operate to maximise achievement of their objectives. This combination of reward structure and individual objectives imply predictable behavioural patterns. Frequently, the behavioural implications of a set of individual objective functions and the incentive structure of the organisation in which those individuals operate give rise to perverse and counter-intuitive conflicts between the induced behaviour and the global objectives of the organisation as a whole or of society.

Almost nothing has been done to study the interaction between objectives of individuals and the explicit and implicit reward structures of academic organisations. This is true despite the fact that many of the anomalies and pathologies observable in educational institutions can be traced to interactions of this kind. A great deal can and needs to be done

to study this phenomenon in the post-secondary educational system. Only after we understand what is happening can we design improved incentive structures to more fully achieve social objectives.<sup>55</sup>

### 3.3. Adjustment Mechanisms

Organisations exist in a milieu or environment that makes certain demands and affords certain opportunities. They acquire inputs from "suppliers" outside the organisation, transform them by some technology into outputs which are goods and services provided to "customers" outside the organisation. The relative scarcity of the inputs and the outputs are usually determined outside the organisation and information concerning these relative scarcities is usually supplied in the form of prices or other indices of deficitness. Technology, of course, determines what can be done by way of transforming inputs into outputs.

Putting all this into the context of post-secondary education, we can see the various educational institutions using inputs (e.g., professors' services, physical facilities,

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Those who are interested in this topic can usefully read the following: Joseph S.Berliner, "The Informal Organisation of the Soviet Firm," Quarterly Journal of Economics, August, 1952, pp.342-365; Alec Nove, "The Problem of 'Success Indicators' in Soviet Industry," Economica, New Series, February, 1958, pp.1-13; Charles L.Schultze, "The Role of Incentives, Penalties and Rewards in Attaining Effective Policy," in Robert H.Haveman and Julius Margolis, Public Expenditures and Public Analysis, Markham, Chicago, 1970, PP.145-172.

books, other media) by a variety of processes (lectures, laboratories, individual study, computer-assisted instruction, etc.), and producing outputs in the form of educational services rendered to students, public service rendered to members of the community and research services.

Consider the demand for the services produced by the system of educational institutions. Students and potential students desire a variety of educational services and experiences that are associated with those services. For any specific unit cost of obtaining those services (stated in terms of foregone earnings, tuition fees and other avoidable expenses) a particular quantity of those services will be demanded. Extending this, we can conceive of an educational demand function relating the amount demanded of various kinds of educational services to the cost of those services.

On the supply side we can conceive of supply functions of the various inputs used in the process of providing educational services. In the short run, certain inputs may be fixed in quantity but, given time, there is the possibility of expansion and contraction in the amount supplied of those various inputs. How much will be provided by the various input suppliers depends upon the price which each can fetch in the market place.

Finally, we can conceive of a technology, a finite number of ways and processes by which inputs may be combined to produce

the educational services. At a particular time and place, the technology may be rather restricted in its variety, e.g., conventional lectures held in classrooms with chalkboards or conventional laboratory instruction held in a particular kind of facility with particular kinds of equipment and staff. In the longer run, it may be possible to use many different processes such as educational television or computer-assisted instruction.

Let us begin our thinking about adjustment processes by supposing that a group of educational institutions is in a state of equilibrium. Given the demand functions for various educational services, we may suppose that the institutions have chosen that technology and combination of input resources which is most appropriate and efficient. Let us now perturb this tranquil state by varying environmental factors of supply, demand and technology. What should and what will be the adjustment response to this perturbation?

Consider the response to a change in demand. Suppose that the preferences of students and potential students undergo a shift because of changing values, altered perceptions of the advantages of certain kinds of education and other things. If the system has a smooth and responsive adjustment mechanism, the shifts in "customer" preferences will be sensed soon and internal changes in the mix of educational services provided will be

undertaken immediately. If the adjustment mechanism is rusty and unresponsive, tradition and inertia will tend to perpetuate the status quo. The result will be frustration and anger on the part of the system's clientele and a shift toward other kinds of activities more adequately able to meet the changing preferences of the customers. It can be argued that the phenomenon of student power and student revolt is a manifestation of creaky adjustment mechanisms in our educational system.

Now let us perturb the system on the supply side. Suppose we have a rise in the relative costs to educational institutions of certain inputs, e.g., professors' services. The appropriate response in this case is to begin the substitution of other inputs for the increasingly scarce professorial time in such a way as to raise the productivity of the professors. If the adjustment mechanism is rigid and unresponsive, this shift will not occur and the cost of post-secondary education will increase artificially.

Suppose, finally, that technology shifts in such a way as to open the possibility of delivering the same quantity and quality of educational services at reduced cost by means of an unconventional combination of inputs, e.g., the widespread use of television. In a responsive system, we would expect the potentials of new technology to be developed and exploited with alacrity. In a rigid and unresponsive system, we should expect

those potentials to go unrealised while tradition holds sway.

It can be argued persuasively that much of the rapid rise in educational costs as well as the growing disenchantment of the public and student clientele is attributable to the unresponsiveness of the existing system of post-secondary educational institutional arrangements.

Referring to the earlier discussion of incentive structures, we may pose certain questions: "In whose interest is it to attentively monitor and respond to changing preferences and needs among students and potential students?" "In whose interest is it to aggressively seek out less expensive ways of delivering educational services of a quality and quantity at least equal to that presently being provided?" "In whose interest is it to substitute relatively inexpensive inputs into the educational process in place of those inputs whose relative costs continue to increase?" These may sound like rhetorical questions but they should not be so. If, within our post-secondary educational system, no one has an interest to be responsive to shifting demand, technology or supply conditions, then the pathologic symptoms of organisational sclerosis will be manifest.

The study and design of adjustment mechanisms for post-secondary educational systems offers rich opportunity for research

and improved policy making. Almost nothing has been done in the area and very significant social payoffs should result from serious investigation.



APPENDIX A

AN ANNOTATED BIBLIOGRAPHY OF SELECTED ITEMS

SUBJECT:	Program Planning and Budgeting System	REFERENCE NO. PPBS-1
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AUTHOR: Harry J. Hartley

TITLE: Educational Planning - Programming - Budgeting:  
A Systems Approach

SOURCE: Prentice Hall, Inc. 1968

PURPOSE: To review the application of PPBS to educational systems.

SUMMARY: Hartley portrays program budgeting as a means for accelerating improvement and advancement in the educational system. At the same time he recognizes that there are certain fears and drawbacks related to PPBS. To some people, "planning conjures up the image of a totalitarian society embracing centrally planned economic objectives and activities" (p.2) and consequently, some people view the economic rationality of program budgeting as an infringement on their domain. Herein lies a sensitive and crucial issue of program budgeting. How, to what extent, and in what manner, should centralized decision-making be balanced against individual decision-making? As long as program budgeting is not considered an end in itself, but rather a means of providing more detailed comprehensive information to the people who then assess the results, program budgeting should not suppress individuality, human privacy or intuitive judgment.

All the same, there are three particular aspects of PPBS which can be detrimental if proper human judgment is not exercised. Primarily, program plans must not be accepted as rigid commitments; that is, just because a certain structural unit exists at one point in time, this should not make it impervious to change. Secondly, there is a latent danger in doing cost comparisons of competing programs or budgetary units for the tendency is to see cost as the major factor, and to attach too little importance to pedagogical benefits or to the justifiable reasons for cost variations. Thirdly, long range projections are subject to miscalculations for planning has its limits, and often unexpected factors are not taken into account.

Hartley sees program budgeting as a means of defining the parameters for educational planning. It relates the output oriented activities of an organization to specific resources that are then stated in terms of budget dollars. Hence, with PPBS, budgeting becomes an integral part of policy formulation. The emphasis

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is on outputs, cost effectiveness methods, long range objectives, and participatory planning, allowing for a delineation of responsibilities in the review of existing structures and policies.

Hartley devotes two chapters of his book to theories of systems analysis. He discusses three concepts of economic systems: input-output analysis, econometric models, and cost benefit analysis. Operations Research, he believes is not completely appropriate for educational PPBS as some problems and situations elude quantification. Also useful in educational planning are Management Information Systems, which have three basic functions: the collection, processing and distribution of data. Planning requires the selection of an action from various alternatives, and the more pertinent alternatives that are made available through the information system, the greater the probability of improving the quality of the decision. Program Evaluation and Review Techniques (PERT) are a device for planning, evaluation, and the identification of critical areas.

CRITIQUE:

Educational Planning - Programming - Budgeting: A Systems Approach provides comprehensive coverage of all aspects of PPBS. Hartley's approach to program budgeting is philosophical (in nature) and so the philosophical questions of program budgeting are thoroughly explored.

Perhaps some of the most valuable content of Hartley's book is his extensive documentation of articles, books and people involved in the field of PPBS.

SUBJECT:	Program Planning and Budgeting System	REFERENCE NO. PPBS-2
AUTHOR:	Dr. Harry Williams	
TITLE:	Planning for Effective Resource Allocation in Universities	
SOURCE:	Commission on Administrative Affairs of the American Council on Education, 1966.	
PURPOSE:	To review the application of PPBS to educational systems.	
SUMMARY:	<p>Dr. Williams' book is an outgrowth of the general concern in the public sector, beginning with the realization that during the 1960's expenditures were rising at a rate far in excess of the growth of incoming revenue. Programming and Budgeting Systems (PPBS) were a response to these problems. It is the purpose of Williams' book to explore the possibilities and problems of PPBS, in the academic institutions, surely the most complex of "businesses" where much of the revenue is dependent on government funds, where the main products are students, and benefits are intangible entities such as education and social mobility. As a non-profit organization the link between income and expenditures is weak, and the measurement and evaluation of its output is difficult. Our schools, colleges and universities are the most needy of PPBS but perhaps they lend themselves to PPBS less easily than private industry.</p>	
	<p>Williams defines program budgeting as having three major phases: Planning, Programming and Budgeting. Planning involves the formulation of the long range comprehensive goals and objectives, the policies of the institution. Programming is the process by which the institution can specify the more immediate, more detailed shorter range goals for each of the operating units. Budgeting is the well thought out formulation of an annual plan, making explicit the composition and extent of all the program elements dealt with in the programming phase.</p>	
	<p>The program budget of an institution should reflect its economic responsibilities and should demonstrate the extent to which present plans and policies contribute to the long range objectives of the institution. In designing the elements of the budget</p>	

## SUBJECT:

Program Planning and Budgeting  
System (cont'd.)

## REFERENCE NO. PPBS-2

structure it is essential to remember that a program budget is a policy planning document, not an accounting data document. The smaller an element, the greater the homogeneity possible, and hence the greater the precision in allocating and controlling resources. Yet too much detail bogs down decision making.

Academic management and the effective allocation of resources must not consist of a once-a-year decision leading to the annual financial report. Faculty and administrators must work together consistently in order to operate the institution at the most desirable level with limited staff, space and equipment available. They must constantly inquire why something is being done in a certain manner. Is the reason still valid? Is this the 'best' or 'preferred' or 'most rational' use of resources? Often because certain budgetary units already happen to exist, and simply because they exist, they are never required to give substantive validation of why, and at what level, they should continue to exist.

Economic analysis does not always have the answers or the solutions, as Williams points out in the Introduction of his book, but analytically supported program budgeting will at least raise the right questions and direct attention to the important trade-offs. The academic administrators in our schools and colleges often do not consider the full cost implications of their present level of activity for the future, but they must if they are to cope with expenditures which may surpass revenue.

Every addition, change, or deletion of a physical resource interacts and is interdependent, not only with other similar resources, but with other activities in the institution. This interdependence can be analyzed with a program budget that reflects the varying impact of resources. Alternative methods of distributing resources can be used in order to find the most economically and pedagogically desirable means.

There are evidently certain problems involved in establishing a program budgeting system in an academic institution. Conceptual problems related to programming the system and structuring the input to suit the institution may arise. Operational problems may arise during the implementation of the system. Moreover,

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there are also institutional problems resulting from the defenses built up by bureaucratic organizations or individuals against change in the established decision making procedures.

CRITIQUE: Planning for Effective Resource Allocation in Universities touches the surface of PPBS. Perhaps it would have been preferable for him to deal more thoroughly with his major thesis - effective resource allocation, rather than touching upon every aspect of PPBS, such as innate problems in academic institutions in relation to PPBS. His theory of the interdependence of resources is of vital importance to the concept of effective resource allocation, and yet it is under-developed.

SUBJECT: Cost Analysis

REFERENCE NO. CA-1

AUTHOR: Croy, L. M.; Research and Planning Officer

TITLE: A Model For The Analysis of Historical Cost

SOURCE: Western Australian Institute of Technology,  
November 1970.

PURPOSE: 1. A synthesis of expenditures incurred by  
departments and their allocation to  
courses.  
2. An analysis of wasted expenditures  
3. Projection of costs

SUMMARY: 1. Allocation of current expenditures by means of  
Leontief Input/Output Matrix is provided on the  
basis of total student hour loads.  
2. Analysis of wasted expenditures, due to:  
a) sub-optimization of physical resources  
b) withdrawals  
c) annual examination failure rate  
d) supplementary examination  
3. Projection of cost stems from the projection  
of course enrolments in terms of student hour  
loads. All relevant costs are projected on  
the basis of the Leontief Matrix, when expected  
expenditures are adjusted firstly by annual  
growth rates reflecting changes in cost structures  
and secondly by inflation rates.

CRITIQUE: 1. The concept of Input/Output Matrix can be very  
useful especially in terms of accuracy, because  
of the balancing properties of these types of  
models. On the other hand, the student hour loads  
factor, which is basic to the model, is a precise  
concept, but requires very laborious data collection  
efforts.

A number of assumptions should be noted:

- a) Average class hours are assumed constant over time
- b) Transition rates are ignored completely (are  
assumed stable over time)
- c) Part-time student appear to have the same hour  
loads as full time students.

SUBJECT:	Cost Analysis (cont'd.)	REFERENCE NO. CA-1
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Despite these the "Equivalent Graduate" can be a useful indicator of output provided that all assumptions are carefully considered.

2. The Wasted Expenditures Analysis is a by-product of allocation procedures and potentially can provide interesting pictures of expenditures incurred due to circumstances in the past.
3. The portion of the model which projects costs bears the same weaknesses as described in 1 above.

SUBJECT:	Cost Analysis	REFERENCE NO. CA-2
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AUTHOR: Warren W. Gulko

TITLE: Unit Costs of Instruction: A Methodological Approach

SOURCE: Planning and Management Systems Division,  
Western Interstate Commission for Higher Education,  
Boulder, Colorado, January, 1971.

PURPOSE: To propose a preliminary basis for the exchange of  
comparable unit cost information.

SUMMARY: An overview of the commonly used measures for analysis  
of higher education programs is presented with specific  
reference to several studies. The author defines his  
"algebra of units costs" in the form of mathematical  
equations which represent the relationships between  
variables and the various unit costs measures.

Special attention is paid to the problem of defining  
the degree cost for one student in terms of:

1. the normative cost
2. the actual average cost
3. the minimum cost

Some results derived from an empirical study to  
determine the cost of a degree-winner are presented.

SUBJECT:	Cost/Benefit Analysis	REFERENCE NO. C/B-1
AUTHOR:	Raymond E. Callahan	
TITLE:	Education and the Cult of Efficiency	
SOURCE:	The University of Chicago Press, Chicago, 1962	
PURPOSE:	To describe the results of the application of scientific management techniques to educational systems.	
SUMMARY:	Raymond Callahan's book deals with the phenomenon of scientific management in elementary and secondary education, primarily as it appeared in the first three decades of the twentieth century. He examines the origins of scientific management, presents a detailed history of its progress in the field of education, and, finally, describes its effects on the educational system in the United States.	
	Callahan sees the United States in the twentieth century as a country preoccupied with business goals and values. Because of the American emphasis on success - and this usually meant material wealth - methods of economic management and business efficiency quickly developed into a respected science. Scientific management with its emphasis on the highest quality for the lowest cost, was transferred from American business management to the management of the American school system. School administrators, responding to bitter criticism of management in education, hailed the new science as an economic savior. Those who were unenthusiastic about business practices in education were pressured into conformity, and the new goal of education became efficiency in the production of students.	
	In this quest for efficiency, Callahan feels that educators exchanged the concept of highest <u>quality</u> at lowest cost for that of highest <u>productivity</u> at lowest cost. Efficient management degenerated into cost accounting or unit costing and the goal of administrators became to educate as many students as possible as quickly and as cheaply as was feasible. This philosophy resulted in assembly line teaching in over-crowded classrooms by overworked teachers.	

SUBJECT:

Cost/Benefit Analysis (cont'd.)

REFERENCE NO. C/B-1

CRITIQUE:

Callaham condemns educational management as the imposition of business values on education by business-industrial groups. His condemnation seems premature. He is criticizing a rudimentary analytical system producing unsophisticated results which were then naively applied. Results which should have been used as bases for further analysis became directives for policy formation. Cost analysis, one useful tool among many in educational planning, became the primary basis and justification for management decisions in education.

Educational management has progressed since the 1920's. Methods of analysis and results from analytical systems have become highly sophisticated. Most important of all, school administrators have developed a more complete understanding of these systems and of their application in educational planning. Further development and research in the field of educational management is perhaps the best answer to Callahan's criticism.

SUBJECT: Cost/Benefit Analysis

REFERENCE NO. C/B-2

AUTHOR: ETS, Inc.

TITLE: The COST-ED Model. A New Economic Tool for the School Administrator

SOURCE: Education Turnkey Systems, Inc.

PURPOSE: Description of the COST-ED Model

SUMMARY: This document presents a brief theoretical discussion of uses for the COST-ED Model. The main body of the paper consists of COST-ED computer report descriptions, their purposes, formats and uses. Also included is a glossary of key terms and expressions used in the reports.

Basically, COST-ED is a historical cost accounting model. Reports show the breakdown of total costs by function, resource type and by characteristics of each resource type. Reports also show the amount and way that each economic factor contributes to total costs.

The main portion of the COST-ED model deals with sensitivity analysis or the assessment of economic impact of changes in cost factors both on total cost and on other cost factors. Reports display economic factors which have the greatest impact on total cost and the requirements generated for these factors by various programs. These reports allow the user to analyze alternative ways of allocating funds, given a fixed cost total.

CRITIQUE: It would have been useful if more details had been included on data collection and input needs. However, this report presents a logically written guide to the structure and capabilities of the COST-ED Model.

SUBJECT:	Cost/Benefit Analysis	REFERENCE NO.C/B-3
AUTHORS:	W. Lee Hansen and Burton A. Weisbrod	
TITLE:	Benefits, Cost, and Finance of Public Higher Education	
SOURCE:	Benefits, Cost, and Finance of Public Higher Education Markham Publishing Company, Chicago, Illinois, 1969.	
PURPOSE:	To establish a methodology for analyzing and quantifying the costs and benefits of public higher education and to relate these to legislative policy for financing public higher education.	
SUMMARY:	Using the Californian higher public education system as a base for illustration, the authors discuss the various problems associated with determining, classifying and measuring the economic and social costs and benefits of higher education. This is done in terms of private, consumption, social (external) benefits, real and opportunity costs, and the distribution of both benefits and costs to taxpayers and students. The purpose of this exercise is defined as being necessary so that cost/benefit analysis can be used in financial planning in order to define appropriate legislative policy regarding sources and degrees of financial support of public higher education.	
	The purpose of this work is not to provide solutions to the complex problems of financing higher education but rather to expose the informational requirements and assumptions that must be taken into consideration in order to effectively arrive at solutions which emphasize factors of equity and efficiency.	
	The authors' analyses indicate that in general, the existing financing system favours the high income groups and in the long run tends to promote more inequality than less. Some of their suggested alternatives to the existing scheme are:	
	<ol style="list-style-type: none"><li>1. Make the tax structure more progressive rather than just proportional.</li><li>2. Subsidize all high school graduates regardless of whether they go to college or not.</li><li>3. Invoke user charges for higher education on the basis of ability to pay and extend large supplements to low-income groups.</li></ol>	

SUBJECT:	Cost/Benefit Analysis	REFERENCE NO.C/B-3
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The conclusion is that until economics and social scientists concern themselves seriously with public education and attempt to quantify cost and benefit indicators, no rational decisions in the financing of public higher education can be made.

SUBJECT:	Cost Benefit and Cost Effectiveness Analysis	REFERENCE NO.C/B- 4
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AUTHORS: Alexander M. Mood and Richard Powers

TITLE: Cost-Benefit Analysis of Education

SOURCE: U.S. Office of Education National Center for Educational Statistics, Division of Operations Analysis, Technical Note No. 27, March 30, 1967.

PURPOSE: To discuss the difficulties encountered with the application of cost-benefit analysis to education.

SUMMARY: The difficulties of applying cost-benefit analysis to education are discussed with reference to the following topics:

1. The goals of education.
2. The complexity of the education process.
3. The multiplicity of federal programs.
4. The educational information gathering systems.
5. Information requirements for program budgeting.
6. Measurement of educational costs and benefits.

The authors indicate that fruitful results are years away, and that extensive research and development programs must be undertaken to overcome the existing difficulties.

SUBJECT:	Cost Benefit and Cost Effectiveness Analysis	REFERENCE NO. C/B-5
AUTHOR:	A. R. Prest and R. Turvey	
TITLE:	Cost-Benefit Analysis: A Survey	
SOURCE:	The Economic Journal, 75, 300 (December, 1965) 683-735.	
PURPOSE:	To describe the general principles, advantages and limitations of cost-benefit analysis.	
SUMMARY:	The authors outline the development and scope of the subject in general terms. They discuss, in detail, the four general principles of cost-benefit analysis. These are:  <ol style="list-style-type: none"><li>1. Enumeration of costs and benefits.</li><li>2. Valuation of costs and benefits.</li><li>3. Choice of interest rate.</li><li>4. Relevant constraints.</li></ol> A survey of particular applications of cost-benefit techniques is confined to those economies which are not centrally planned. The uses made of these techniques in a variety of fields including education is examined.	

SUBJECT:	Cost/Benefit Analysis	REFERENCE NO.C/B-6
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AUTHOR: Robert G. Spiegelman  
Martin Gorfinkel  
Mordecai Kurz  
Samuel Weiner

TITLE: A Benefit/Cost Model to Evaluate Educational Programs

SOURCE: Stanford Research Institute,  
Menlo Park, California

PURPOSE: To develop an analytical model for the purpose  
of comparing and evaluating alternative programs  
for education. This report was prepared for  
the U. S. Office of Education, Washington, D. C.

SUMMARY: The mathematical model developed in this report  
represents a method of evaluating the success of an educational program in terms of the economic objectives of a society since these can be quantified. The cost/benefit approach has been taken since it is assumed that the market mechanism is insufficient in allocating resources efficiently, due to its many imperfections. The program used is "Title I" of the Elementary and Secondary Education Act. The purpose of the study was not to arrive at definite conclusions about this specific program but to use it as a test case in developing an appropriate analytical tool. It is felt however, that the model that was developed could be validly applied to the evaluation of other similar programs for helping children from disadvantaged backgrounds.

In evaluating more than one new program the emphasis is placed on the marginal contribution to society's welfare, rather than the average, since marginal gains (or losses) resulting from reallocation of resources is the relevant economic measure. The criteria involved in selecting one program out of many is to maximize the present value of all benefits less that of all costs taking into consideration certain constraints.

Costs and benefits must be expressed in the same terms and since many benefits cannot be expressed in monetary terms the authors were forced to limit their variables involved on the benefit side to (page 7):

SUBJECT:

Cost/Benefit Analysis (cont'd.)

REFERENCE NO. C/B- 6

- Increase in personal income due to graduating from high school and going to college
- Intergeneration benefits
- The reduction of juvenile crime

Using special survey and census data equations were developed to compute the probability of and quantify the benefits that could be generated to students as a result of "Title I" as opposed to pre "Title I" students. The present dollar value of these private and social benefits to each type of student involved was compared with the cost per pupil of the Title I" program resulting in a positive ratio indicating justification for the program.

CRITIQUE:

Keeping in mind that the authors' purpose was not to evaluate a specific program but instead to create an analytical capability to do this, the shortcomings of the analysis are clearly defined by the authors. Because of the limited data available the analysis of Title I was restricted to the comparison of only a few selected benefits and costs. These benefits could only be accrued to four general types of students, male and female, negroes and non-negroes. Very few conclusions can be drawn from the analysis since the data only spanned one year and therefore increases or decreases of these benefits over time were not considered. The study was also restricted to one geographical area and is not necessarily representative of the nation as a whole.

The approach taken is logical and consistent but until sufficient data is made available to expand the scope of such studies it is unlikely that comparative results can be received and acted upon with confidence.

SUBJECT:	Cost Benefit and Cost Effectiveness Analysis	REFERENCE NO.C/B-7
AUTHOR:	Aaron Wildavsky	
TITLE:	The Political Economy of Efficiency: Cost-Benefit Analysis, and Program Budgeting	
SOURCE:	<u>Public Administration Review</u> , 26, 4 (December, 1966), 292-310.	
PURPOSE:	To consider whether political rationality is being displaced by economic efficiency in governmental decision-making.	
SUMMARY:	The characteristics, strengths, and weaknesses of the most popular modes of achieving efficiency, cost-benefit analysis, systems analysis, and program budgeting are identified. It is found that the contribution of the mode is valuable to a point, but then begins to produce limitations which must be recognized by the public and public officials using these methods of analysis. The primary weakness is seen as the inability to measure the output of changed values and certain appreciation and enjoyment gains that cannot be quantified. Since political considerations and societal benefits become so critical in government activities, these factors cannot be ignored when administrators enter into program evaluation tasks.	

SUBJECT:	Educational Output Measurement	REFERENCE NO.EOM-1
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AUTHOR: Henry S. Dyer

TITLE: The Pennsylvania Plan

SOURCE: Science Education, 50, 3(1966), 242-248.

PURPOSE: To describe a plan for evaluating educational programs.

SUMMARY: The Pennsylvania Plan for evaluating the quality of educational programs was brought into being by an Act of the Pennsylvania General Assembly. The section of the Act entitled "Educational Performance Standards" outlines the purposes of the study which are as follows:

1. To develop a procedure for measuring "objectively the adequacy and efficiency of the educational programs of the public schools of the Commonwealth".
2. To "devise performance standards" based on these measures, and
3. To use the data from the evaluation process to help each school district strengthen its educational program.

There are five main emphases emerging from the Pennsylvania Plan:

1. Direct public involvement in the shaping, re-shaping, and execution of the Plan.
2. Continuous review of the educational ends to be sought, the measures to be employed, and the levels of school performance to be attained.
3. Great breadth in the purposes of education underlying the evaluation program.
4. A cumulative program of research leading to the continual improvement of educational practice.
5. Encouragement of intelligent diversity in the educational programs of local districts for the sake of meeting the diverse needs of the student population.

SUBJECT:	Educational Output Measurement	REFERENCE NO.EOM-2
AUTHOR:	John Keller	
TITLE:	Higher Education Objectives: Measures of Performance and Effectiveness	
SOURCE:	Western Interstate Commission for Higher Education (WICHE)	
PURPOSE:	To define the problem of measuring performance and effectiveness in higher education, propose some standard terminology and submit some ideas for development of systematic analyses.	
SUMMARY:	Keller states that given limited resources, the problem facing academic institutions is the minimizing of cost per unit of output. This he calls efficiency. He examines only efficiency of instructional programs and in this context defines such terms as "effectiveness" (or value added), "output", and "benefits".  He then proposes several methods of evaluating quality according to benefit indices, thus establishing the comparative efficiency of an institution and the effectiveness of techniques used in choosing alternatives for resource allocation.	
CRITIQUE:	In his article Keller proposes some interesting theories and methods of analysis. However, he himself admits that these theories are not applicable given the present state of analytical systems and the lack of available data. His purpose is to suggest the direction of future development.	

SUBJECT:	Educational Output Measurement	REFERENCE NO. EOM-4
AUTHOR:	Fredric D. Weinfeld	
TITLE:	Educational Quality: Definition and Measurement	
SOURCE:	U.S. Office of Education, National Center for Educational Statistics, Division of Operations Analysis Technical Note No. 4, September 2, 1966.	
PURPOSE:	To discuss the problem of evaluation of quality of education.	
SUMMARY:	The author presents a review of the problems and misconceptions which have arisen with respect to the evaluation of the quality of education. It is pointed out that the effectiveness of a school is often measured in operational terms. For example, a particular school has a highly paid staff, and therefore, is a "good" school. The author indicates that in order to have meaningful measures of quality of education, the goals of education must be specified and the criteria of these measures must be determined. The change in student level of educational achievement is given as a reasonable criterion measure of the quality of schools. Some projects involved with this problem of evaluation are briefly discussed.	

SUBJECT:	Educational Output Measurements	REFERENCE NO. EOM-5
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AUTHORS: Editors: B. Lawrence, G. Weathersby and V. Patterson

TITLE: The Outputs of Higher Education: Their Identification, Measurement, and Evaluation, July, 1970.

SOURCE: Western Interstate Commission for Higher Education, Boulder, Colorado.

PURPOSE: To survey the problem, conceptually analysis and suggest some approaches to the measurement and evaluation of the outputs of higher education.

SUMMARY: The problem of educational output measurement is surveyed and analysed by several different experts. This document represents a collection of papers organized in different areas of the problem.

The approaches to the measurement of these outputs is offered at 4 levels:

- . student
- . public service
- . undergraduate
- . graduate

CRITIQUE: Probably the most recent comprehensive effort on this subject and may prove to be a mile stone.

SUBJECT:	Other Bibliographies and State of The Art Review	REFERENCE NO. OSR-1
AUTHOR:	Juan A. Casasco	
TITLE:	Planning Techniques for University Management	
SOURCE:	American Council on Education with the Eric Clearinghouse on Higher Education	
PURPOSE:	Outline of representative work done in the field of university planning models	
SUMMARY:	Casasco presents outline analyses of selected computer assisted university planning programs. He describes and compares operational programs - comprehensive as well as specialized. One comprehensive program and several specialized programs in the developmental stage are outlined as well.	
CRITIQUE:	Casasco structures a conceptual framework for university planning, then presents 21 case studies against this framework. The information given is necessarily simplified and limited. However, Casasco's report is a useful reference guide for interested model users.	

SUBJECT: Other Bibliographies and State  
of The Art Review

REFERENCE NO. OSR-2

AUTHORS: George B. Weathersby  
Milton C. Weinstein

TITLE: A Structural Comparison of Analytical Models for  
University Planning

SOURCE: Office of Analytical Studies, University of  
California

PURPOSE: To provide a conceptual framework for the evaluation  
of analytical planning models designed for application  
in institutions of higher education and to compare  
many of the models currently available.

SUMMARY: Weathersby and Weinstein structure their review of  
mathematical models according to seven categories:

- 1) Function of the model
- 2) Theoretical foundation
- 3) Techniques or methods used
- 4) Subjects of the model
- 5) Data sources
- 6) Uses of the model
- 7) Operating status of the model

The models examined are further grouped according to  
type:

- 1) Comprehensive University Simulation Models
- 2) University Performance Optimization Models
- 3) Special Purpose University Models
- 4) National Educational Planning models

The report also includes a summary of future  
developmental needs.

CRITIQUE: This report provides an excellent general introduction  
to resource allocation models. It can be a useful  
technical guide for planning staff at universities and  
colleges.





